UNDERSTANDING ARCHAEOMUSICOLOGY

Ten Lessons on Archaeomusicology

Especially dedicated to my wonderful son Jeremie

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ICONEA

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MS 2340 in the Schøyen collection

This Sumerian cuneiform text dating from around 2600 BC is the oldest ever attestation of music. It lists 9 types of musical strings and 23 types of musical instruments, according to the description in the collection. Thus, Sumerian music was well organised over 5,000 years ago, or about two thousand and a half years before any Ancient Greek music appeared. The earliest surviving text on music theory is the *Harmonic Elements* by Aristoxenos, written in the fourth century BC. However, this text was only known much later when it appeared in a Latin translation in 1564 AD, but no original manuscripts by the author have survived. On the other hand, there are music treatises written in Old-Babylonian some 4000 years ago onward which are contemporary with their inception. The oldest notated song comes from the Near-East and dates from about 1400 BC while the Greek epitaph of Seikilos dates from the first or the second century AD.

For more information about MS 2340, see Miguel Civil: The Lexical Texts in the Schøyen Collection, *Cornell University Studies in Assyriology and Sumerology*, vol. 12, Manuscripts in the Schøyen Collection, Cuneiform texts V. CDL Press, Bethesda, MD, 2010, text 6.3.1, pp. 203-214.

Ipse se nihil scire id unum sciat[1]

Should you wish to understand anything about music in antiquity, generally, and in the Ancient Near and Middle-East, specifically, then, you must forget everything you know, or you think you know about music theories and practices. You must forget about diatonism, heptatonism, octaves, staves, clefs, Pythagoras[2], etc., and if you persist you will end up with an illusion of systems, but most importantly, you must close your eyes and open your ears as music is meant to be heard and not meant to be read.

Unsurprisingly, the linguistic evolution would have run concurrently to the cultural and therefore the musical transformation probably fuelled by the agricultural revolution[3] around 12,000 years ago in Western Asia. Agriculturalists, unlike hunter gatherers, favoured exogamy, as it best suited their expansionist ambitions, which, as a consequence, led to the spreading of language and therefore, of music, which in Western Asia and probably elsewhere, resulted in a transition from biconsonantal to a triconsonantal morphology[4], a concept which has been substantially discussed by friend and colleague Nidaa Abou M'rad in his magisterial work *Éléments de Sémiotique Modale*[5] which I had the privilege of translating into English under the title of *Elements of Modal Semiotics*[6].

M'rad wrote that '...the perception of melodic intervals and the observation of phenomena linked to acoustic otoemissions place at the foreground of a certain selective hierarchisation located at the core of the auditory neurosensory, a system which favours the transduction of the interval of the third, in an innate manner while adhering to cognitive order-acquired regulations.'

Most would agree, that a reflexive progenitive[7] form of musical enunciation would have existed long before any form of theory was conceived (although some believe that humankind, ubiquitously, came along with an ascending[8] diatonic heptatonic system etched within the unconscious). It is certain that the concept of theory did not arise out of anywhere. Slowly and organically, the elusive idea osmosed through generative layers of non-octaval, non-linguistic, non-numeric, oligotonic[9], hemiolic[10], eventually reaching a tangible meaning through the filtering of cognitive processes until the eclosion of a coherent writing system, around 3500 BC in the Middle-East and North-East Africa. This phenomenon shaped these processes at a time and at a place where pitches were sung as horizontal consecutive monodic syllabic intonations, one syllable for each pitch, excluding vertical heterophony, as a voice cannot sing two pitches simultaneously[11]. It would take time, probably with the development of collective chanting and later, with musical instruments, which are extensions of the voice, to envisage a form of embryonic heterophony, yet very far from any form of polyphony and even further from any consonantal harmonic processes.

The oldest city states, five thousand years ago, and human gatherings even further away from us, such as at Göbekli Tepe and beyond, would have been entertained with singing, it goes without saying, and with instrumental music that we can imagine from the evidence as extant types such as lyres excavated from the royal graves at Ur, one of which, the famous silver lyre[12], hosted at the British Museum (BM 12199) dated from around 2600 years BC, some idiophones such as clay rattles[13] (BM 116869; 1927,0527.249), etc.; a cylinder seal from the Uruk period, some 3200 years BC, representing a woman playing a tubular zither, ancestor of the lute, while sitting at the back of a narrow boat (BM 141632, around 3500-3200 BC)[14]; some pre-Sumerian pictographs representing a simple arched harp, another with an undefined instrument, probably a drum (ZATU 47, around 3200 BC; LAK 41, around 2600 BC; LAK 387, around 2600 BC)[15]; etc., all amounting to a meagre assemblage compared to the abundant evidence from Ancient Egypt. However, some enthusiastic fame-seekers have claimed the discovery of Neanderthalian flutes on the basis of a few holes roughly drilled, so they thought, on a bone fragment from a baby bear's femur but which were proven to be gnarled by some carnivorous animal in search of succulent bone marrow[16]. On the other hand, China has produced crane-wing bone flutes known as the Jiahu gǔdí (贾湖骨笛) which are the oldest known musical instruments from China, dating back to around 6000 BC. 'Gudi' means 'bone flute' (unrelated to Sumerian 'gù.dé' meaning 'lute', Akkadian *'inu', 'pitnu'*) dated from around 6000 BC, at the neolithic site of Jiahu[17].

And so, music was not born, and neither was language. Both came bound to one another as proto or palæo-melodic syllables, for lack of better terms, from the deepest rifts where the entwined roots of Darwin's tree held onto the rugged particles of human evolution. These melodic syllables were intangible for they came from the mouth, yet unwritten for hundreds of thousand years to come. Initially, they would have come as response to a stimulus. A caress, for instance, provoking a radical melodic syllable from the recipient, as a response, which in turn would become a recipient's desire for an amorous fondle or the like. It was probably the order, the manner, or the mood of the intonation, which eventually distinguished the melodic syllable of the response, from the melodic syllabic contour of the request. There would have been reflexive melodic syllables coming as exclamations, at the encounter with some ferocious animal, such as the guttural screech at the sight of a beast, or the sibilant phoneme emulating the hissing of a snake, as psychogenesis of both the signified, or the shape of the snake, and the signifier, the hissing. There would also have been polygenetic melodic syllables arising from the imitation of the ubiquitous barking of a dog, so would have been cries of pain, purrs of pleasure, eructations of bodily functions, and other sounds common to humankind, generally. This is why some words are similar in all parts of the world without having any common linguistic origin.

We can only voice what we can hear, and thus, melodic syllables found their sources from the soundscapes whence we dwelled, and so, early melodies took specific forms as a consequence of the frequency of their emission and reciprocally, of their perception as a constant exchange of segmental phonemes and of suprasegmental features of pitch vocalisation leading to some structural morphology.

It will not come as a surprise that music came from the human voice and that it started with a single pitch, or tonal centre, the frequency height of which placed spontaneously where most comfortable for the singer. It will also be obvious that a pitch above and a pitch lower from the tonal centre would have constituted the three members of the triconsonantal generative cell. In the course of a three-stepped melody, the upper pitch would have been interrogative, the lower, conclusive and the middle, discursive or suspensive, but this is a very generalised hypothesis about the nature of early intonations.

It is further contended that the intervals between these seminal pitches would have measured an approximate tone, not exceeding a tone and a half or being less than a minor tone, but again, these are very questionable appreciations which are nevertheless based on a wide analysis of ethnomusicological practice, children's spontaneous melodies, football-fan vociferations, and evidence from the interpretation of Ancient Near-Eastern archaeo-musicological texts. The question is why was this approximate tone adopted as the basic step by humankind from their origins to this day. I propose that it corresponded to physically preferential tensions of vocal folds in relation to the atmospheric environment of this gaseous mixture we have breathed in since our origination, allowing for the vibration of our vocal folds at specific frequencies and favouring the generation of natural harmonics of a fundamental pitch. Hence, in such an environment, our voice would have been drawn towards the fifth (3/2), and the tone (9/8); but what of the octave (2/1), of the fourth (4/3), of the major third 5/4) and of the minor third (6/5)? The answer is that the octave would never have been used in any early melodies: its span would not have been significant and moreover difficult to achieve, as is the case with ethnic, football and children's intonations which seldom use it. This interval appeared much later for the purpose of dynamic swelling, but in antiquity, it would only have been considered as the place where women and children sang: it is almost certain that the concept was not initially understood as it is one thing to produce octaves in a mixed group of males and females/children, and another to understand its concept as we do nowadays, being the relation of 2/1 and its implication at the core of the so-called Pythagorean and other Western theories. I do not even think that our ancestors would even have been perturbed with it. Thirds, major and minor would have been too indistinguishable from one another, hence the natural predisposition for the neutral third which sits, beautifully, (350 cents + 350 cents = 700 cents) just in the middle of the fifth and framed by two small tones at its boundaries. Thus, there is a privileged relationship between the fifth and the tone which, however, brought up a dilemma as one cannot fit four such tones in an fifth. It is also axiomatic that the practice of singing in music prehistory had not yet been burdened with any questioning about the nature of intervals which were sung spontaneously: it all would have come innately, and it is only much later, when epistemology revealed a relationship between spontaneous intervals and harmonics, that theory was borne; but theory is not music.

Sachs wrote[18] that 'Because in the current of culture and time [...] alternation patterns grew often from one step to two steps, from two to three steps, and so forth, the conclusion would seem logical that litany-like melodies on one note (or nearly so) must be older even than two-note melodies. But counting is a poor help in cultural history, the more so as repetition and alternation seem to differ beyond comparison, one exhibiting the need for either rest or for tension, and the other, for leisurely motion. The only statement that we dare propose is: one-note, as well as two-note formations belong in the earliest age of man. Those who believe in a parallel evolution of the human individual and the human kind will be satisfied to find both the one-note and the two-note formations among the very first babble songs of small children.'. The psychologist Heinz Werner recorded such songs a few decades ago[19]" and wrote that 'It is exciting experience to learn that the earliest known stages of music reappear in the babble songs of small children in European countries. For once the ontogenetic law is confirmed: the individual summarises the evolution of mankind. These children could not be suspected to have been influenced by a single trait of our own music. Thus we cannot but accept their babbling as an ontogenetic reiteration of man's earliest music and, inversely, conclude that the music of today's most primitive peoples is indeed the first music that ever existed[20].'.

This perception of ontogenetics seemed to have been a bit hasty as if it were about the development of behavioural features from the earliest stages to maturity, it is difficult to agree that a foetus in its uterine amniotic environment would not be conditioned by a multitude of sounds for the duration of some nine months, well enough to develop a cognitive appreciation of what it had heard. Therefore I feel that the replication of pitches and intervals at a very young age would be reasonably inaccurate because of the infant's lack of synchronisation between what it heard and retained, and its ability to replicate accurately, not what it heard but what it thought it had heard. Children do not always voice what they hear and do not always hear what they voice because this depends mainly on ability to retain tonal elements of an early 'good musical education'. A young child might not be able to repeat the two consecutive pitches of a neutral third, but when they spontaneously sing a monody, the neutral third might come naturally. But was it the child's intention to sing that very third?

Then we would be understandably excused to draw a similarity between children's development of musical abilities with the phylogenetic development of music in other groups among which supporters of football matches. Mass-incantations vociferated by thousands of inebriated fans are mostly spontaneously synchronistic and phylogenetic types of monodic anhemitonic oligotonic forms.

The simplest enunciations of music may belong to ethnic groups, children or football fans but in each case they have purpose and even with a small amount of primary pitches they may yield a great variety of modal inflections generated by variations of interval sizes, dynamic, stress, rhythm, timbre, quality and meaning of the supported or supporting text, etc.

However, some collections of ethnic music are found with larger spans. With an example, from the Arthur Morris Jone collection, played on a Mpiemo xylophone recorded in the Cameroon in 1970[21], the xylophone spans 11 pitches on 1,521 cents. It is therefore a descending hendecatonic hypermodal system. Some will object to our inclination in associating the span of an instrument to a system but one may never assume that pitches beyond the octave are strayed and should necessarily be brought back into the octaval fold where, as we are told, they are meant to belong, as is often thought.

In the present case, there are eleven pitches with intervals between them never under 100 cents and never above 300 cents. There is, however, a notable pattern of alternation between short and long intervals. From the treble to the bass, the pattern is: short; long; short; long; short; long; short; long, short and short. The succession of two short intervals in the bass is indicative of the practice in other cultures to accumulate shorter intervals at the bass of a system but the reason might be, in this case, that the tuning of wood blades is more difficult to perceive in the bass thus explaining this tonal imprecision.

Our own observations show, in the three cases, ethnic, children, and populist masses, that thirds never clearly adhere to our Western notion of 'major'; 'neutral'; and 'minor'. These intervals are sung in whatever size fits the mood and are in synchronisation with the tuning of instruments, such as chordophones and aerophones, (by the technique of partially blocking finger-holes). With lamellophones such as xylophones (balafons) or 'thumb pianos' (kalimbas/mbiras), sound sustain is so short that their approximation is sufficient to match voice intonations when both are in approximate fusion. From our own experience and especially from past accounts of illustrious ethnomusicologists, the interval of the fifth would be a preference with the three aforementioned groups. It would seem logical that if our vocal folds have a predilection for the just singing of the fifth, rather than any other intervals, that in reciprocation the ear would also prefer the hearing of these intervals. We would add that the hearing of the two simultaneous pitches of a fifth are not perceived in the same manner as the same two pitches when played consecutively for the reason that both, if produced simultaneously, are part of the harmonic series of the fundamental and therefore blend within the whole harmonic series of a same fundamental while when the same pitches are played consecutively, then, the two pitches sound as the fundamental of their own harmonic series, a fifth apart. The greater the time lapse between the emission of both pitches, the greater their dissociation with their initial fundamental. This phenomenon is even more observable with equal temperament minor, (≈63/50), [just intonation 6/5] neutral (≈153/125) and major thirds (≈44/37), [just intonation 5/4], which become less distinguishable when distantly consecutive.

For evidence of triconsonantal intonations, I have chosen an earth bow from the Cameroon[22]. It consists in a young and flexible branch growing from the ground. This branch is then bowed as an arc over the musician's back. A string of some kind, most probably vegetal, is tied to the tip of the bow and attached to some root or some bark held to the ground by the musician.

The musician tenses the bow lifting it with the back of their hand or fingers, thus tensing the string, generating an arbitrarily chosen 'e' at 200 ± 30 cents higher than the axis 'D'; then, the bow is left in its natural 'neutral' tension to the pitch of 'D'. Next, the musician presses the bow downward with the inside of their hand or fingers thus relaxing the string to the estimated pitch of 'b' 200 ± 30 cents below the axis 'D'. It is probable that the relaxing of the string which would have needed less effort would have resulted in a larger interval than treble counterpart. These gestures would have triggered generative cognitive processes by which, in congregational chanting, for instance, the officiant raises their hand for higher pitches and lowers it to indicate lower pitches. We find an elaboration of these chironomic instructions with plain-chant as shown below where the green line indicates hand gestures in relation to the square notation:

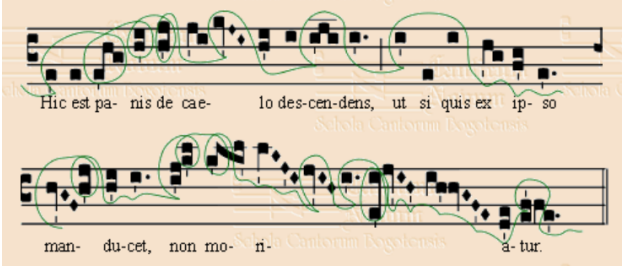


Figure 1. Vaticano, Biblioteca Apostolica, *Archivio San Pietro* B.79, f. 14v.

The movements of the musician's hands as shown with the Cameroonian earth-bow player are of the same cognitive nature as the movements of the officiant's hands which metaphorically locate pitch heights, the higher the hand, the higher the pitch with a middle position, comparable to the Cameroonian bow when neither tensed, nor relaxed. It is this status of neutrality which would have led to the first single stave line and its pitch value as shown below:

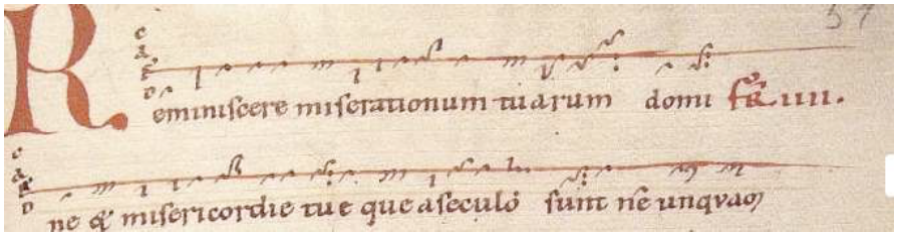


Figure 2. Graz, Universitätsbibliothek 807, f. 51.

Thus the line in the figure above is given as the receptacle of 'f', and suggests that other lines would soon be added for pitches 'c', 'a' and 'd', as shown below:

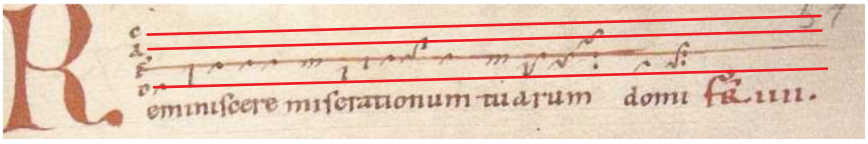


Figure 3. Author's addition of red pitch lines, or staves.

Thus we find sources for chironomic instructions in ethnomusicological occurrences as we would have found them in prehistoric practice, it is contended. As we shall see later, the lexical structure of cuneiform text UET VII, 126 (pp.25-33) sets the cognition for a tonal symmetrical axis, or tonal palindromy, which found itself channelled into the precursory proto-UET VII, 126, and of UET VII, 126, itself, during the first millennium BC, where pitch 'D' is the tonal centre with two equidistant pitches, an 'e' and a 'c' as shown below, which will be evaluated in depth later in the present study:

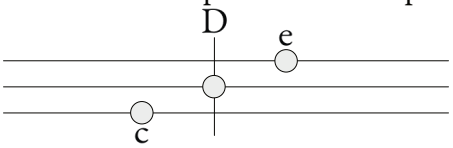


Figure 4. The generative triconsonantal third.

In our reconstruction of CBS 10996 (pp.67-80), this interval is recorded in Akkadian as *šalšatu*[23] meaning 'third', the ordinal. The addition of two pitches, one at the treble and one at the bass would lead us to a dilemma involving the addition of either a semitone at the treble = 'f' and a tone at the bass = 'b♭', the intervals between them amounting to a fifth bringing an imbalance as 'b♭'-'D' = four semitones or two tones while 'D'-'f' = three semitones or a tone and a half. However, this theoretical 'imbalance' would have been inaudible to our pre-literate ancestors who would have simply ignored the problem and probably divided the fifth into two neutral thirds and thirds into two neutral seconds as: 0 cents, 175 cents, 350 cents, 525 cents and 700 cents. With time, the interval of the tone would have adjusted to around 200 cents as a consequence of its relation to the fifth and avoiding the semitone, a quantity which they would not have been able to intone in the same way most Westerners cannot intone the Maqamian quartertone[24].

This is how hemiolic anhemitonic systems evolved: the interval of the fifth with two tones and a gap of a tone and a half, or to put it more explicitly: g--a---c--d; a---c--d--e or c--d--e---g, in all three cases hemiolic anhemitonic systems, eventually leading to pentatonism.

It is now appropriate to include Dom Jean Claire's theory of archaic intonation. In his *Quelques mots sur la paléographie*, Léon Gautier[25] wrote that 'the progress imposed on the study of sources with historical and archaeological sciences is clear. Thus, there is no longer any erudite who does not respect the law that the École des Chartes established, from its earliest lectures to paleography students: 'Sources, always sources, and never rely on secondary sources (our translation)."

In his *Gregorian Chant*[26], Dom Daniel Saulnier writes about the pentatonic scale, its origins and mentions Guido of Arezzo as the theoretician having preserved the 'three possible ways of notating it' as follows:

*g - a - * - C - D - E - * - g - a*
*c - d - * - F - G - A - * - c - d*
*d - e - * - G - A - B - * - d - e*

Saulnier was wise taking Guido of Arezzo not as the conceptor of this system but mainly as its transmitter. According to Dom Saulnier, in Dr. Mary Berry's translation, the three degrees in the middle of these scales are what Dom Jean Claire called 'mother-notes'. They are the roots of archaic psalmody. The asterisk between the outer notes of the minor third represent the *pien*[27]. This is a weak, non-structural note, of negligible importance, often missing, but which can also make its appearance in a melody. It is mobile - that is to say, that it can move either higher or lower within the minor third (trihemitone) according to the centre of gravity of the melody. Many pieces of Gregorian Chant have kept these characteristics, notably the *In splendóribus* below:

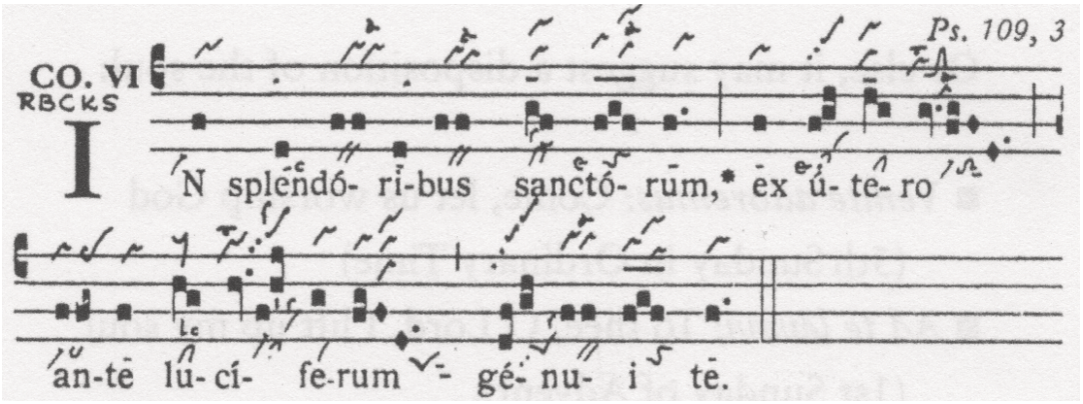


Figure 5. Psalm 110 (*Vulgate* 109) in the *Old Testament*: *In splendoribus sanctorum, ex utero, ante luciferum, genui te* which may translate as 'in the splendour of saints, from the womb, before light, I begot you.' (*Douay Bible*, 1610).

Dom Saulnier established a similarity between the *pien* and the *quilisma,* and wrote, in Mary Berry's translation, that 'It is quite remarkable to see that the earliest musical neumatic notations had from the very first, special signs to indicate certain details of this scale: the *quilisma* (see below) was used for the weak degree (*piena*) and the *stropha/ strophicus,* (see below) for the strong, the one above the semitone. In the form of notation, that finally prevailed, only a single mobile *pien* remained, the 'B', which can be either natural or flat, two possible positions - principle mutually exclusive.'.

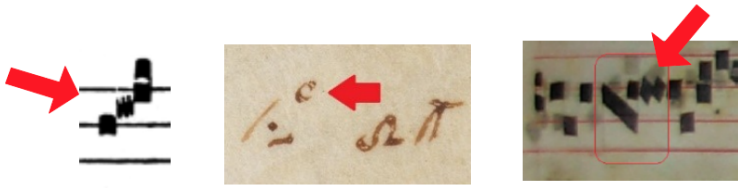


Figure 6. Hymn *Immense cæli conditor* (*hiemalis*). From the *Antophonale Monasticum*. Solesmes, 1934, p. 136. Left, *quilisma* between *punctum* and *podatus*; middle) *strophicus* as neume; right) *strophicus* and *quilisma* in square notation are composed of lozenges or jagged lines.

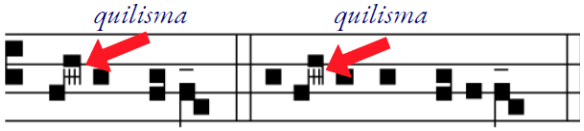


Figure 7. V/ *Sursum corda* R/ *Habemus ad Dominum*.

It is evident that the function of the trihemitone, re-discovered by Dom Jean Claire, remained of great importance in Gregorian compositions. With the *Sursum corda* all four trihemitones written with *quilismata* are located on accentuated syllables: *Sú*($3^1/_2$)*r sum corda*. *Habé*($3^1/_2$)*mus ad Dominum. Gratias agá*($3^1/_2$)*mus Domino Deo nostro. Dí*($3^1/_2$)*gnum et iustus est*.

Non-octaval Hypermodes[28] are special schemes of tonal organisations which have been ignored mainly for the reason that they did not suit traditional diatonic octaval followers who, for the most, have rejected anything beyond. Non-octaval hypermodes originate from the Ancient Near-east as we shall see later, and were adopted by the Ancient Greeks as *systema metabolon* or 'modulating system', also called 'Lesser Perfect System'. They flowed into Byzantine chant and in Western Europe as the Daseian scale which was wrongly understood as a series of four repeating fourths as:

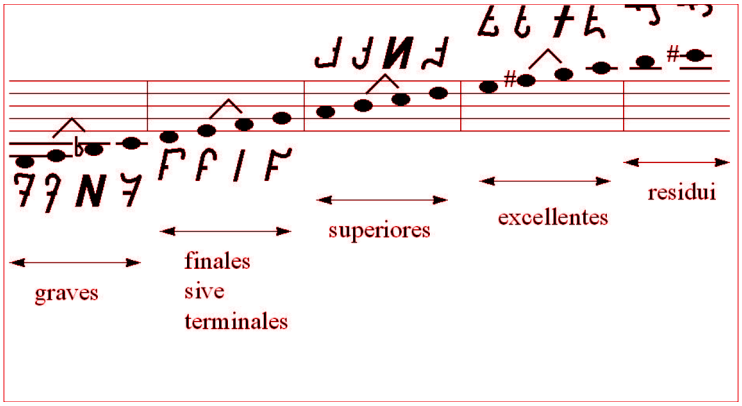


Figure 8. Daseian scale *Dasia notatio* from the *Musica et scolica enchiriadi*s around 900 AD.

However, we would read this sequence as a series of fifths:

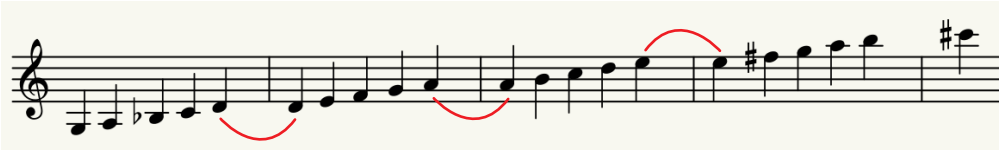


Figure 9. Daseian scale as a series of fifths

This arrangement became the Georgian pentachordal hypermode as shown below as a pentatonic Dorian hypermode:

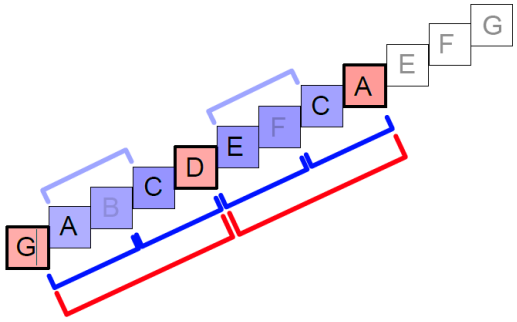


Figure 10. Pentatonic Dorian hypermode.

This pentatonic Dorian hypermode is identical to the system described in UET VII, 126 which is, we contend a conjunctive text between prehistorical, ethnomusicological, literary, and plain-chant articulations.

Text UET VII, 126 which is comprehensively analysed later in this volume can be reduced to its simplest expression as: 1) fore string; 2) second string; 3) third thin string; 4) small string/Ea-created; 5) fifth string; 6) fourth rear string; 7) third rear string; 8) fourth rear string; 9) rear string.

The analysis of the previous hypotheses reveal both a consistent growth and reduction of transformative generative systems by means of chains of conjoined thirds. It is significant, as shown on the graphic overleaf, that the heptatonic system is the exception as it differs structurally from all other systems in that it is made of two conjunct fourths. We contend that the cause of this discrepancy is that heptatonism is the consequence of a cyclical concept as described with the analysis of text CBS 1766 (pp.61-66) in this volume, while all other systems are systemically linear. Nevertheless, heptatonism retains, at least in its generative form the location of the *pien* or *quilisma* and the *stropha* known in UET VII, 126 as 'third thin string/*quilisma*' and 'small string/Ea created [string]', both pitches delineating the Procrustean[29] dissonance.

The graphic overleaf explains the reason for anhemitonism/pentatonism as a device for avoiding the interval of the semitone. Furthermore, it confirms the enneatonic transformative generative nature of UET VII, 126 thus making a clear distinction between the linear concept of its transformative generativeness and the cyclicality of text CBS 1766.

Conclusion

It is remarkable that the Sumerian/Akkadian nomeclature in UET VII, 126 which came from a late fourth millennium orality sailed right through time, in a written transposition of its orality, into Sumerian lore, into Old, Middle and Neo-Babylonian

periods, then via the Jewish and later first millennium AD Christian verbal archaic enunciations in the Levant, in Rome, and in the Occident, to reach our shores, safely, keeping immaculate its original signification and most importantly, without an iota of Greek interference.

However, Isodore of Seville, (560-636) wrote that if sounds are not memorised by man, they are lost as it is not possible to write them down and therefore theory, it must be understood, is nothing more than a poor attempt at converting orality into deficient signs.

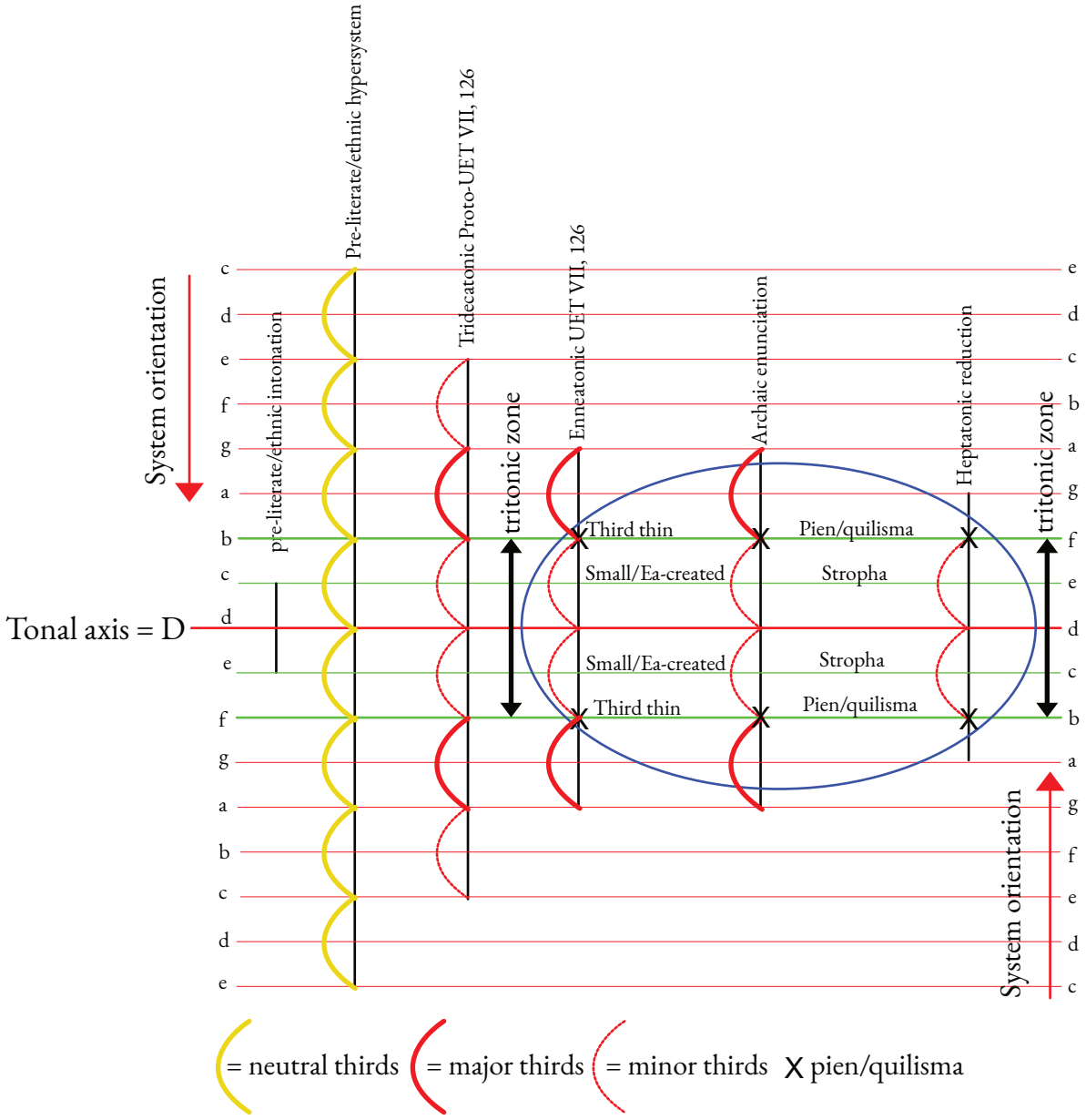


Figure 11. Chronology of the development of musical systems from pre-literate times to the application of heptatonism and its continuation.

Endnotes

[1] The phrase, originally from Latin 'ipse se nihil scire id unum sciat', is a possible paraphrase from a Greek text. It is also quoted as 'scio me nihil scire" or "scio me nescire'. It was later back-translated to Katharevousa Greek as "[ἕν οἶδα ὅτι] οὐδὲν οἶδα". A variant is found in von Kues, *De visione Dei*, XIII, 146 (*Werke*, Walter de Gruyter, 1967, p. 312): '...et hoc scio solum, quia scio me nescire [sic]... [I know alone, that (or because) I know, that I do not know]. https://en.wikipedia.org/wiki/I_know_that_I_know_nothing

[2] Πυθαγόρας ὁ Σάμιος, 'Pythagoras the Samian', or simply Πυθαγόρας; Πυθαγόρης in Ionian Greek; c. 570 – c. 495 BC. His life has been clouded with mythology but it is certain that what he would have written about music theory had been known, in Mesopotamia, at least a thousand years before he was born.

[3] The First Agricultural Revolution around 10000 BC was the prehistoric transition from hunting and gathering to settled agriculture. It was also known as the Neolithic Revolution.

[4] Noam Agmon and Yigal Bloch, Statistics of Language Morphology Change: From Biconsonantal Hunters to Triconsonantal Farmers. Institute of Chemistry, Department of Jewish History, The Hebrew University of Jerusalem. https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0083780&type=printable

[5] Abou M'rad, Nidaa, *Éléments de Sémiotique Modale*. Essai d'une grammaire musicale pour les traditions monodiques. Geuthner, (Paris 2016).

[6] Forthcoming

[7] By 'reflexive' I mean that the earliest linguistic/musical intonations would have come from responses to stimuli which would have been replicated by the members of a group in the same way other idiosyncrasies propagated from one individual and then spread throughout a group and became a singular trait specific to that group, and eventually a recognisable tongue and a specific music for that group.

[8] Probably inherited from Jacob's Ladder (Sūllām Ya'aqōv) is a ladder leading to heaven which was featured in a dream the biblical Patriarch Jacob had during his flight from his brother Esau in the Book of Genesis (chapter 28).

[9] Interval having less than five degrees.

[10] *Hemiola = sesquialtera* which is the interval of 3:2 = 702 cents, the perfect fifth.

[11] In principle, since there are two vocal folds, two simultaneous pitches are possible but normally, the folds are stretched to the same tension to produce the same pitch as they respond to a neural synchronisation for both folds, but in some abnormal cases a growth or obstruction of one of the folds may cause it to vibrate at a different pitch than the other thus producing two different pitches simultaneously, of course the subject cannot have any control over an affected fold.

[12] Dumbrill, R., *Rediscovering the silver lyre of Ur, ICONEA* 2010. ISBN 978-1-458-39442-2

[13] Dumbrill, R., *Idiophones of the Ancient Near East in the collections of the British Museum,* Gorgias Press, 2011, ISBN-10: 1611439566

[14] Dumbrill, R., *Musical Scenes and Instruments on Seals, Sealings and Impressions from the Ancient Near East in the Collections of the British Museum,* ICONEA Publications, LONDON (2015), ISBN 978-1-326-28932-4

[15] Krispijn, Th., 'Musical ensembles in Ancient Mesopotamia' *in ICONEA 2008, Proceedings of the International Conference of Near-Eastern Archaeomusicology held at the British Museum, December 4, 5, and 6, 2008. ICONEA* publications, LONDON, 2010, p. 130.

[16] Dietrich Caius G.,published by rso.royalsocietypublishing.org: The 'cave bear cub femora with holes' are, in all cases, neither instruments nor human made at all. All cave bear pseudo-bone flutes are not dated to Neanderthal Middle Palaeolithic Mousterian layers, but instead, if possible to date, to Late Palaeolithic, Aurignacian/Gravettian layers. There, where they are dated absolutely (Divje Babe Cave 1) are without archaeological context at all, and simply of cave bear den use during the MIS 3–5d. At these times, different cave bear subspecies Ursus spelaeus subsp. eremus (smallest cave bear) and spelaeus (i.e. Neanderthal times) and U. ingressus (largest cave bear, i.e. Aurignacian/ Gravettian times) used caves all over Europe for cub raising and hibernation. All the large carnivore punctured cave bear cub femora (and other punctured bones) appear always in small to large cave bear den cave/cave entrance contexts. This sometimes overlaps with hyena dens and human camp sites at cave entrances only, where cave bear den, carnivore den and human

remains are even mixed up (partly separated in layers), all over Europe due to competition for and seasonal use of cave entrances/rock shelters. The cave bear bones with round–oval, larger puncture marks can be well attributed solely to the main cave bear scavenger of Europe - the Ice Age spotted hyena Crocuta crocuta spelaea. This main Late Pleistocene bone destructor in Europe is known recently with more than 150 den sites (95% are cave sites) all over Europe. At cave bear dens hyenas left, by periodic scavenging, up to 20% of damaged bones, whereas also lions (cave bear killers), leopards and wolves played a larger role in the cave bear hunting/ scavenging, even deep in caves. Those indeed also left, in some cases, round-oval, larger punctures in cave bear bones, but with their canines only in soft spongiosa (pelvis, vertebrae), and never in any bone shaft compacta. Neither carnivores nor cave bears (herbivorous) used their canine teeth to crush long-bones, or any other bones. Therefore, all other top predators - except hyenas - can be excluded, at least for the round-oval punctures in cave bear long-bone shafts. Only hyenas have developed a carcass destruction and butchery strategy, also for cave bears. This strategy is demonstrated, herein in detail, on cave bear femora destruction (especially material from Weisse Kuhle Cave, Germany) which is presented in three stages and for different aged individuals - cubs (less than 1 year), sub-adults (1-2 years) and adults. Cub bones are 'soft' and thin-walled in the bone shaft compacta, which increases in sub-adults to adults. This explains why puncture marks are found only in cub (less 1 year) femora, and partly in sub-adults, whereas they are absent completely in adults, because hyenas cracked those bones into pieces with the premolar triangle teeth (i.e. bone crushing teeth) for access to the bone marrow and easier swallowing of those pieces for the bone collagen use. Hyenas left, therefore, 'pseudo-bone flutes' during the Late Middle to Late Pleistocene all over Europe in cave bear dens, and on different cave bear species/ subspecies. This is known due to lack of breakage on most of the cave bear cub femora, which generally show additional diagonal zigzag margins (from chewing joints by scissor teeth of hyenas) or have triangular or smaller scratch tooth marks. This even allows reconstruction, in some cases in detail, the tooth mark of the upper and lower jaw teeth of hyenas - the last tooth mark of the premolar bone crushing triangle of the powerful jaws of the last hyenas of Europe. Finally, some flakes and refitted cub femora, both with tooth mark holes, prove the bone cracking activities at cave sites.

[17] https://www.metmuseum.org/toah/hd/jiah/hd_jiah.htm

[18] Sachs, Curt, *The Wellsprings of Music,* op.cit., p. 72.

[19] Werner, Heinz, Die melodische Erfindung im Frühen Kindesalter, in *K.K. Akademie der Wissenschaften zu Wien*, Phil. -Hist. Klasse, Sitzungsber., vol. 182 (1907), no. 4. - See also Bruno Nettl, Infant musical development and primitive music, in *Southwestern Journal of Anthropology*, vol. 12 (1956), pp. 87-9I.

[20] Sachs, Curt, *The Rise of Music in the Ancient World (New York, 1943) pp. 43-44.*

[21] It is available from the British library Sound Archives: (https://sounds.bl.uk/World-and-traditional-music/Arthur-Morris-Jones/025MC0424X0030XX-0100V0).

[22] https://www.youtube.com/watch?v=CjDlvi_Wr3c&t=35s&ab_channel=bakabeyond

[23] See *Chicago Assyrian Dictionary,* vol. shin_1. p. 263 *sub šalšu.*

[24] The Maqamian quartertone is never used as an independent quantity. It is always added to other intervals, meaning that there are no series of quarter tones in a melody but there are quartertones added to other intervals of the second and the third, principally.

[25] Gautier, Léon. Bibliothèque de l'École des chartes, Année 1858 19 pp. 568-569

[26] Saulnier, Dom Daniel, *Gregorian Chant, A guide to the History and Liturgy*. Paraclete Press, Brewster, MA, USA (2017, fourth printing in English), p. 53.

[27] Saulnier, Dom Daniel, fn. 53, p. 139, In Mary Berry's words: The word *pien* comes the Chinese language: it is used for the two notes that transform the traditional Chinese pentatonic scale into a scale of seven notes. See Josef Yasser, *A Theory of Evolving Tonality* (New York: American Library of Musicology, 1932), p. 34.

[28] Nikolsky Aleksey. Evolution of Tonal Organization in Music Optimizes Neural Mechanisms in Symbolic Encoding of Perceptual Reality. Part-2: *Ancient to Seventeenth Century. Frontiers in Psychology*, 2016. (https://doi.org/10.3389/fpsyg.2016.00211) It is however regrettable that the description of Ancient Near Eastern musicology has been described through the subjective and mostly biased views of one of the reviewers of this article. This has resulted in some incorrect facts about the music of the Ancient Near-East.

[29] I use the term 'Procrustean interval' to designate the Akkadian *la zaku* 'not clear' as this term does not relate to any historical value. Four our purposes in this work, we will say that it could be the fourth F-B or the fifth B-F, both having 6 semitones.

My understanding of Ancient Mesopotamian music theory

These few pages place my theories about the musicology of Ancient Mesopotamia at the foreground. Then, they are compared to the evidence, and comprehensively discussed in the following chapters.

The alphabetic notation used throughout is only illustrative and not meant to imply any equation with the tonometric values of Western quantifications and nomenclatures.

Ancient Mesopotamian music theory was based, principally, but not exclusively, on chains of conjoined step-melodic intervals of the third (or intervals containing pitches within the boundaries of the interval, played consecutively). Melodic intervals of the third (or intervals of empty thirds played consecutively) would also have been used, occasionally. However, harmonic intervals, dyads or dichords, (intervals of two pitches played simultaneously) would have happened accidentally rather than by design. In the earliest Antiquity, step-melodic melodic thirds would probably have been roughly neutral (around 350 cents, containing two neutral tones of around 175 cents), and then became either major (around 400 cents, containing two tones) or minor (around 300 cents, containing a tone and a semitone) with the rise of literacy. Similarly, music cultures of the more recent past as well as examples from contemporary ethnomusicology also show that intervals were and are mostly step-melodic although with some unintentional heterophony, yet far away from consonantal harmony and it would not be surprising, therefore, that it is from Ancient Mesopotamia that came the practice.

There is evidence that as early as the Old Babylonian period, 4,000 years ago, these melodic and step-melodic thirds had specific names with numbers locating them within a defined grid of various hypersystems, with up to 15 degrees. It is probable that they had earlier Sumerian appellations dating from at least 2600 BC on account of extant archaeological evidence such as with lyres excavated at Ur, especially the silver lyre (BM 121199)[1] the string layout of which being consistent with text UET VII, 126 where Sumerian names of strings have Akkadian equations although some Sumerian terms are second millennium Neo- and even Post-Sumerian translations of Akkadian[2].

Third and second millennium theory

There are seven intervals of step-melodic thirds that we know from our interpretation of a hypothetical precursor of text CBS 10996 (proto CBS 10996 (p. 78)). As far as we know, they are rising although the evidence comes only from from Professor Gurney's second interpretation of text UET VII, 74[3] which dates from around 1800 BC.

1 *šeru*	d-e-f	(minor third) (tone-semitone)
2 *šalšatum*	c-d-e	(major third) (tone-tone)
3 *rebūtum*	b-c-d	(minor third) semitone-tone)
4 *isqum*	a-b-c	(minor third) (tone-semitone
5 *titur qablītum*	g-a-b	(major third) (tone-tone)
6 *titur išartum*	f-g-a	(major third) (tone-tone)
7 *serdû*	e-f-g	(minor third) (semitone-tone)

Figure 1. Akkadian order and nature of the intervals of the third.

Two ascending melodic thirds conjoin as descending step-melodic fifths:

(Thirds in black, fifths in red, enneatonic scales in blue)

titur išartum	f-g-a	+	*isqum*	a-b-c	=	*nīš tuḫrim*	c-b-a-g-f
serdû	e-f-g	+	*titur qablītum*	g-a-b	=	*išartum*	b-a-g-f-e
šeru	d-e-f	+	*titur išartum*	f-g-a	=	*embūbum*	a-g-f-e-d
šalšatum	c-d-e	+	*serdû*	e-f-g	=	*nīd qablim*	g-f-e-d-c
rebūtum	b-c-d	+	*šēru*	d-e-f	=	*qablītum*	f-e-d-c-b
isqum	a-b-c	+	*šalšatum*	c-d-e	=	*kitmum*	e-d-c-b-a
titur qablītum	g-a-b	+	*rebūtum*	b-c-d	=	*pītum*	d-c-b-a-g

Figure 2. Conjoining of thirds to generate fifths.

Two descending melodic fifths conjoin as descending enneatonic scales:

nīš tuḫrim	c-b-a-g-f	+	*qablītum*	f-e-d-c-b	=	*išartum*	c-b-a-g-f-e-d-c-b
qablītum	f-e-d-c-b	+	*išartum*	b-a-g-f-e	=	*qablītum*	f-e-d-c-b-a-g-f-e
išartum	b-a-g-f-e	+	*kitmum*	e-d-c-b-a	=	*nīš tuḫrim*	b-a-g-f-e-d-c-b-a
kitmum	e-d-c-b-a	+	*embūbum*	a-g-f-e-d	=	*nīd qablim*	e-d-c-b-a-g-f-e-d
embūbum	a-g-f-e-d	+	*pītum*	d-c-b-a-g	=	*pītum*	a-g-f-e-d-c-b-a-g
pītum	d-c-b-a-g	+	*nīd qablim*	g-f-e-d-c	=	*embūbum*	d-c-b-a-g-f-e-d-c
nīd qablim	g-f-e-d-c	+	*nīš tuḫrim*	c-b-a-g-f	=	*kitmum*	g-f-e-d-c-b-a-g-f

Figure 3. Conjoining of intervals of the fifth to generate enneatonic scales

Enneatonic scales accumulate into a pentatonic hypersystem with D as tonal centre:

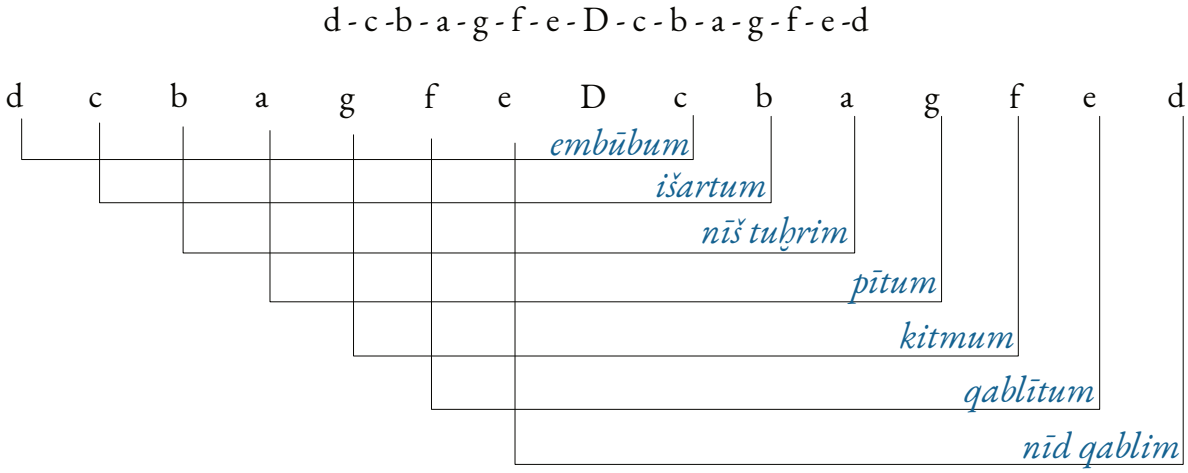


Figure 4. The seven dynamical enneatonic descending scales populating the pentatonic hypersystem.

The scale of *pītum* stands right in the middle of the ambitus; the interval of the fifth, *qablītum* meaning 'middle' sits at the centre of the enneachord *pītum* with 'D' as tonal centre. Note that because of its symmetrical structure, the scales can be inverted: *embūbum* d-c-b-a-g-f-e-d-c may also be *embūbum* d-e-f-g-a-b-c-d-e; *išartum* c-b-a-g-f-e-d-c-b may also be *išartum* e-f-g-a-b-c-d-e-f, etc.

					e	D	c	archaic intonation 'mother-notes'					
				f	e	D	c	b	middle *qablitum* 'Procrustean' interval				
			g	f	e	D	c	b	a	heptatonic system			
		a	g	f	e	D	c	b	a	g	enneatonic hypersystem, scale of *pītum*		
	b	a	g	f	e	D	c	b	a	g	f	hendecatonic hypersystem	
c	b	a	g	f	e	D	c	b	a	g	f	e	tridecatonic hypersystem
d	c	b	a	g	f	e	D	c	b	a	g	f	e	d	pentatonic hypersystem

Figure 5. General structure of the Ancient Mesopotamian system showing perfect symmetry with its chains of step-melodic thirds stemming from 'archaic mother-notes'.

The description of the formation of descending step-melodic fifths and descending enneatonic scales would have been preceded by a far older principle having found its roots in preliterate times. It would have been based on the same idea of conjoined ascending melodic thirds.

The prehistory of this system would have infiltrated into text UET VII, 126 where it left its mark, and which we have reconstructed, enlightened by Dom Jean Claire, and his concept of archaic enunciations as a basis for plain-chant. This text rests on an axial/central pitch of symmetry to which I have ascribed 'D', for illustrative purposes, and for the reason

that it is also the axis of symmetry in Western musicology, a principle which would have come from the Ancient Near-East. However, this will remain conjectural on account of polygenesis. Therefore, this symmetry would suggest that initially intervals might have been ascending or descending, as its consequence, and that, for example, descending fifth *niš tuḫrim* c-b-a-g-f could also have been its ascending reciprocal e-f-g-a-b.

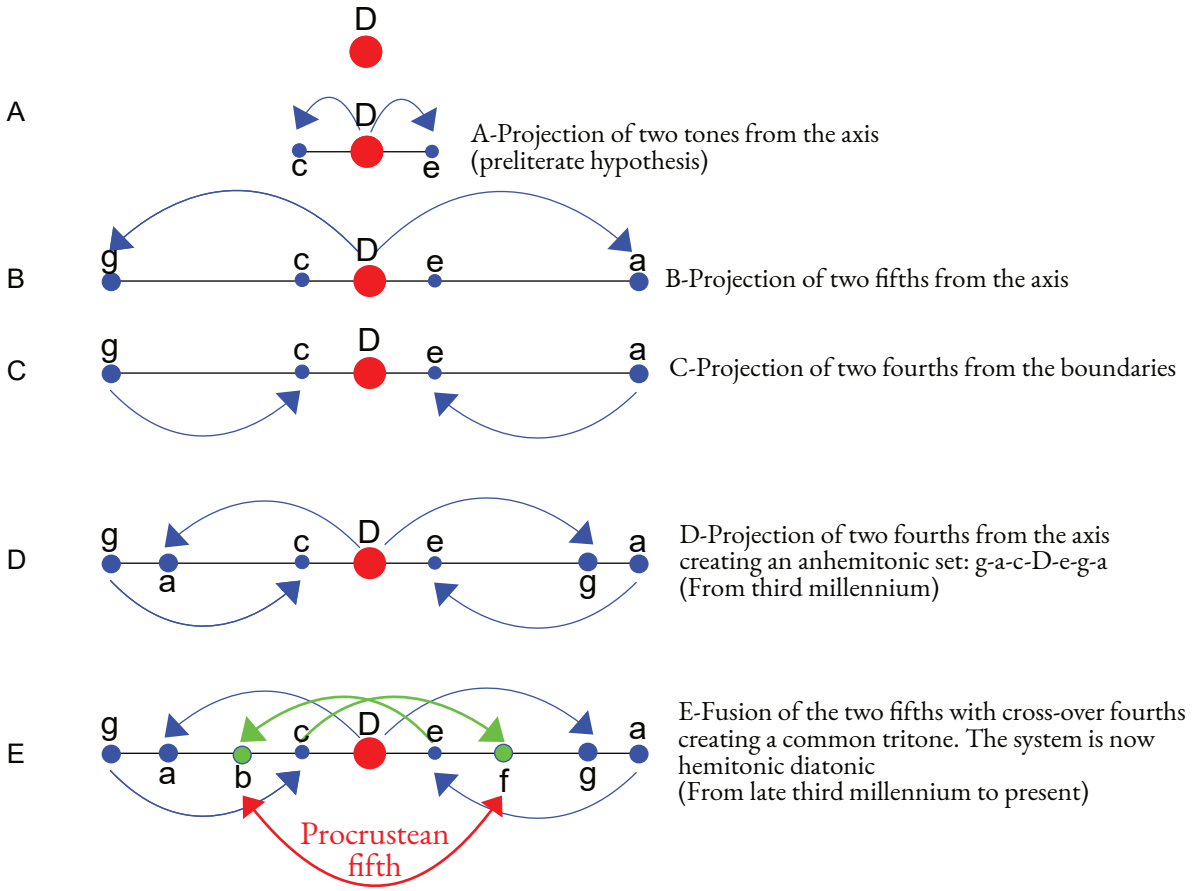


Figure 6. The phases of systemic evolution leading to the diatonic enneatonic system.

This axial 'D' would have had two equidistant pitches, one at its treble and one at its bass and was the foundation cell for all systems thereafter. From this axis, two fifths would have been projected, one to the treble and the other to the bass, and so on, as explained with the graphic above.

This illustration explains the evolution from the fundamental third, in example 'A', and its growth into example 'D' which is the anhemitonic system as known from Guido d'Arezzo onward until Dom Jean Claire's discovery within earliest forms of plain-chant. In the present description from text UET VII, 126, it would be g-a-x-c-d-e-x-g-a, the 'x' indicating the void of a tone and a half where the 'b' and the 'f' will later stand in their semitonal value in relation to 'c' and 'f', respectively (p. 30, figs. 5-6). In example 'E', we have a diatonic enneatonic structure where the Procrustean[4] interval sits right at the centre of the system and links both fifths into a single structure. This Procrustean fifth is called

murub$_4$ in Sumerian and *qablītum* which in Akkadian means 'middle part, inner part', appropriately. The *CAD* is inaccurate when it says, I quote: 'Interval between the second and fifth strings of a harp...'. Firstly, the interval *qablītum* is only placed between the second and fifth strings, from the middle of the first millennium BC when the enneatonic system became expectant of a central heptatonic system as described with CBS 10996, and secondly, the instrument mentioned is not a harp but a lyre as will be later elucidated.

Thus the generative scale described in example 'E', a-g-f-e-d-c-b-a-g which came to be known as the scale of *pītum*[5], appropriately named as it means 'opening', hosts five melodic fifths:

	embūbum	=	a-g-f-e-d
	nīd qablim	=	g-f-e-d-c
	qablītum	=	f-e-d-c-b
	kitmum	=	e-d-c-b-a
and	*pītum*	=	d-c-b-a-g

Figure 7. The five fifths in the scale of *pītum* in our reconstruction of proto-CBS 10996.

as well as five melodic thirds:

titur qablītum	=	g-a-b
isqum	=	a-b-c
rebūtum	=	b-c-d
šalšatum	=	c-d-e
šeru	=	d-e-f

Figure 8. The five thirds in the scale of *pītum* in our reconstruction of proto-CBS 10996.

Thus, the generative descending scale of *pītum* a-g-f-e-d-c-b-a-g would need additional pitches, two at the treble and two at the bass, c-b-a-g-f-e-d-c-b-a-g-f-e amounting to a tridecachord, to host the seven melodic thirds and the seven melodic fifths mentioned earlier. Now, the scalar ambitus, that is the span which could hold all seven enneatonic scales, was pentadecachordal, anhemitonic and hemitonic during the early third millennium. It became enneachordal anhemitonic and hemitonic during the second millennium and heptachordal anhemitonic and hemitonic from early to middle first millennium BC.

The seven ascending melodic thirds and the seven descending melodic fifths would have been arranged in alternation as a precursor of text CBS 10996:

niš tuḫrim	c-b-a-g-f
šeru	d-e-f
išartum	b-a-g-f-e
šalšatum	c-d-e
embūbum	a-g-f-e-d
rebūtum	b-c-d
nīd qablim	g-f-e-d-c
isqum	a-b-c
qablītum	f-e-d-c-b
titur qablītum	g-a-b
kitmum	e-d-c-b-a
titur išartum	f-g-a
pitum	d-c-b-a-g
serdû	e-f-g

Figure 9. The seven descending fifths and ascending thirds in our reconstruction of proto-CBS 10996

The arrangement of these intervals covered the string plan of a tridecachord or a hypersystem of thirteen pitches at the core of which had lain the generative enneatonic scale of *pītum* appropriately meaning 'opening' as it is from this scale that all others developed, keeping pitch 'D' as tonal axis.

We have seen how the seven scales of the system in the third millennium BC were build from the conjoining of descending melodic fifths. This resulted in the disposition of the various pitches on a large ambitus of fifteen degrees which meant that if a musician wanted to play melodies in the seven scales of the system, he would have needed an instrument fitted with fifteen strings. This is what is called the dynamical disposition in a hypersystem. However, a musician with an instrument fitted with the nine strings of the enneatonic model could have retuned his instrument to a scale of his choice, but this meant that he might not have been in tune with other instruments tuned dynamically. There is also the matter of the span of melodies which were composed. It is doubtful that they extended beyond the fifth and therefore the tuning of an instrument in one enneatonic scale could have allowed the playing of melodies in five different hemiolic scales or melodies contained within a fifth, for instance, should the instrument be tuned in the enneatonic scale of *išartum* c-b-a-g-f-e-d-c-b, the musician could have played five different hemiolic melodies:

1) *niš tuḫrim* = c-b-a-g-f, (semitone/tone/tone/tone)
2) *išartum* = b-a-g-f-e, (tone/tone/tone/semitone)
3) *embūbum* = a-g-f-e-d, (tone/tone/semitone/tone)
4) *nīd qablim* = g-f-e-d-c, (tone/semitone/tone/tone)
5) *qablītum* = f-e-d-c-b, (semitone/tone/tone/semitone)

Figure 10. The five fifths within the scale of *išartum*.

We note that the five melodic fifths have different structures each with their specific 'mood', to avoid using the term 'mode' which has been badly corrupted in the course of centuries. These melodic fifths are probably at the origins of *ajnas*[6], building blocks of the Oriental Maqam system.

The problems arising from a dynamic disposition of the seven scales which required an instrument fitted with fifteen strings was resolved at the beginning of the second millennium BC as has been evidenced with text UET VII, 74 (pp.41-60). The theory within is one of the greatest inventions in the history of music theory. It is a transformational generative system. It finds the interval which hosts the unclear *la zaku* or Procrustean interval of the fifth. The musician is instructed to tune up or down, one or two strings by the quantity of a semitone. The outcome is a new scale where as a consequence, the Procrustean fifth is placed between two different pitches and is then corrected as instructed, and so forth, until reaching the initial scale, a semitone higher. This system generates a thetical disposition. For instance, scale *išartum* c-b-a-g-f-e-d-c-b tuned as *niš tuḫrim* is now c-b-a-g-f#-e-d-c-b; *išartum* c-b-a-g-f-e-d-c-b tuned as *embūbum,* for instance becomes c#-b-a#-g#-f#e-d#-c#-b. However, thetical intervals vary from the dynamic ones because the tuning of the former introduces alien intervals to the latter dynamic spectrum. The advantage of the thetical disposition is that the various

tunings in the seven scales remain on the same strings without the need for fifteen strings as was required with the dynamic disposition. The drawback of this tuning is that the musician would have had to go through a lengthy retuning sequence should he needed to play in another scale, while the dynamic method would not have required such manipulations.

In Ancient musicology, span and systems were confused. For instance, text UET VII, 74 is evidently written for a hendecachordal system. Let us remember that it is based on the repositioning of melodic fifths and the only ambitus which allows for such melodic fifths to remain in their original structure is the order given in our reconstruction of a precursor of text CBS 10996 (pp.68-80). In its application of the text for an enneachord, as it was written in UET VII, 74, two intervals need to be inverted, for instance, *pītum* in the tridecachord is melodic fifth d-c#-b-a-g# while in the enneachord it is g#-f#-e-d, a melodic fourth and *kitmum* melodic fifth e-d#-c#-b-a# is melodic fourth a#-g#-f#-e. In the heptachord, melodic fifth *qablītum* is melodic f-e-d-c-b and becomes melodic fourth b-a-g-f; melodic fifth *nīd qablim* g-f#-e-d-c# becomes melodic fourth c#-b-a-g; melodic fifth *pītum* becomes melodic fourth g#-f#-e-d; melodic fifth *kitmum* becomes melodic fourth a#-g#-f#-e; melodic fifth *qablītum* becomes melodic fourth b#-a#-g#-f#. Now what does this prove? Simply that there had been different types of ambiti/systems which were used at different periods and would also have run concurrently. The pentadecachordal span which hosted the seven systemic dynamic enneatonic scales and the tridecachordal thetical systemic ambitus co-existed mainly during the third millennium BC. The enneachordal ambitus would have hosted the enneatonic system, thetically, during the second millennium BC while the heptatonic systemic ambitus arose from the early to the middle of the first millennium BC.

From around 600 BC, two texts illustrated the shift from enneatonism to heptatonism, CBS 1766 and CBS 10996. This significant shift was based on a radical change. The system which was linear became cyclical. This linearity came from the cognitive principle by which systems came from the placing of strings on the yoke of the lyre. This system was known until very late in the history of the development of theory up to Boethius (480–524 AD), and later with Salinas (1513–1590 AD) and others, in the West, etc. On the other hand, cyclical schemes were known in the Middle-East from the thirteenth century, notably with Safi al-Din al-Urmawi's (1216-1294 AD) in *Kitab al-Adwār*[7], but it is certain that the principle was known from around 600 BC, estimation of the date at which CBS 1766 was written. Yet, the archaeological discovery of a text dating from a specific period does not mean that the application of the theory within began at that time, but only means that the system was then known. Additionally the discovery of a single text, does not mean that the theory was generally adopted, at that time. It might have been the consequences of an isolated theoretician's elucubrations. Who knows? Evidence in archaeology is found by chance and not by design. However, when a second text from the same period is unearthed, such as CBS 10996, and confirms the theory of the first one, then some credibility may be given to the otherwise conjectural theory in the first text. This is precisely what happened with the difference that in fact, it was the second text which was first interpreted.

However, for our purpose, we shall describe what CBS 1766 (p.61-66), says. The tablet has an heptagram inscribed within two concentric circles. At each vertice of the heptagram are numbers and at the side of each, the name of a string as known from text UET VII, 126. Thus, the system described has seven strings and therefore can be construed as evidence for a heptatonic system. Additionally, there are columns below the heptagram, one of which gives paired numbers in the following order: 2-6; 6-3; 3-7; 7-4; 4-1; 1-5 and 5-2. Taking the system as descending and on the basis that the vertice labelled '1' and named 'first string', we may assume that '1' and 'first string' are a 'c', as known from CBS 10996. Thus '2-6' would equate to the descending melodic or step-melodic fifth b-e or (b-a-g-f-e); '6-3' would be ascending melodic or step-melodic fourth e-a or (e-f-g-a) ; '3-7' would be a-g-f-e-d, etc. The issuing scale resulting from the alternation of descending fifths and ascending fourths would be b-a-g-f-e-d-c.

Text CBS 10996 has the following sequence of numbers: 1-5; 7-5; 2-6; 1-6; 3-7; 2-7; 4-1; 1-3; 5-2; 2-4; 6-3; 3-5; 7-4 and 4-6. Thus these two texts prove each other's heptatonism. However, the consequence is that some fifths are inverted into fourths and although this has little relevance, harmonically, it has systemic consequences, melodically, as to content, for there is no evidence that intervals were other than step-melodic or melodic as the concept of harmony was yet centuries away.

We contend that heptatonism came from the transition from enneatonism as when linear enneatonism metamorphosed into a cyclical system, the two opposite pitches coincided with each other thus making them redundant as seen below in figure 4 where we use a rope stretched and then looped to explain the system of coincidental extreme pitches g and a:

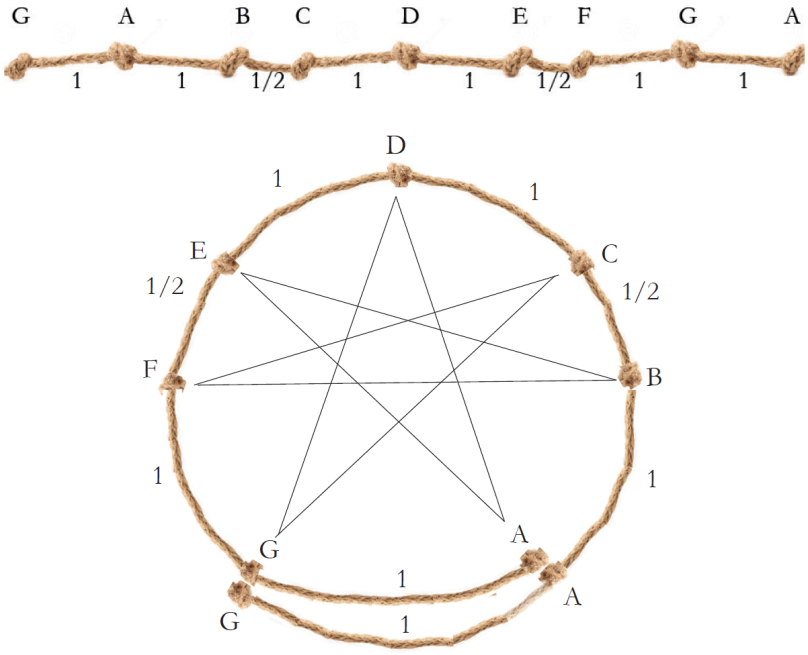


Figure 4. Enneatonic generative scale in a 'rope' linear pitch dispersion with 'D' as axis of symmetry. Tones and semitones are labelled '1' and '1/2' respectively, and its cyclical heptatonic transformation.

Earlier, I mentioned that the three systems, tridecatonic anhemitonic and diatonic hemitonic; enneatonic anhemitonic and diatonic hemitonic and diatonic heptatonic would have co-existed during the course of their consecutive developments. For example, the large Elamite/Assyrian harps depicted on stone slabs illustrating the the battle of the Ulai River, also known as the Battle of Til-Tuba or the Battle of Tulliz, in 653 BC, between Assyrians, under their king Ashurbanipal, and Elamites, had a large number of strings certainly suggesting a tridecatonic, and even a pentadecatonic dynamic tuning although it is believed that at that time, the predominant system was heptatonic. This is further evidence that the discovery of a heptatonic treatise such as CBS 1766 at about the same period as the famous battle is not evidence of a systematic usage of one system, exclusively, at a given time.

In the 1950, French archaeologists working at the site of Ras Shamra in Northwest Syria unearthed a series of some 29 fragmented cuneiform texts, some badly burnt almost to glass. One tablet could be reconstructed from three pieces. The texts are now safely hosted at the museum of Damascus. Tablet H.6 (pp.93-96) is the oldest written music ever found. It includes the music and the lyrics, the scale in which the piece should be played, the name of dedicatee gods, the name of the scribe having written the text and most importantly, the name of a composer, which is a first in the history of music. The melody was written with step-melodic intervals and the rhythm was indicated by numbers following the names of the step-intervals giving the length by which the last pitch of an interval was to be prolonged. However, it is doubtful that this notation system became widely used and we believe it was a one off exercise, in the light that in the Orient, music is traditionally learnt from imitation and not from notation.

Endnotes

[1] Dumbrill, R., *Rediscovering the silver lyre of Ur*.

[2] The history of written Sumerian can be divided into several periods: Archaic Sumerian – c. 2900 BC to c. 2600 BC; Old or Classical Sumerian – c. 2600 BC to c. 2100 BC; Neo-Sumerian – c. 2100 BC to c. 1700 BC; Post-Sumerian – after c. 1700 BC.

[3] Gurney, O.R., Babylonian Music Again*, IRAQ*

[4] I use the term 'Procrustean interval' because it has no historical indication of its quantification. I use it to translate the Akkadian term *la zaku* which mean 'not clear' and can be either the fourth f-b or the fifth b-f, both intervals made up of 6 semitones.

[5] The CAD has in definition C: Substantive (a musical term), Old, Middle and Neo-Babylonian. However, the author did not understand the context for the word which would have better suite the definition B: opening ritual, opening ceremony, better suite for this term in relation to its systemic function.

[6] The Arabic term 'ajnas' which describes intervals of different sizes and polarity was said to come from the Greek 'genos'. However, we have Babylonian '*ginû*' meaning normality in OB, but also descendant. Sanskrit *jánas* meaning descent, race, class of beings, and later, Latin gĕnŭs. Therefore the Greek adjective was obviously borrowed from Old- Babylonian.

[7] Safi al-Din al-Urmawi al-Baghdadi (Persian: صفی الدین اورموی) or Safi al-Din Abd al-Mu'min ibn Yusuf ibn al-Fakhir al-Urmawi al-Baghdadi (born c. 1216 AD in Urmia, died in 1294 AD in Baghdad) was a renowned musician and writer on the theory of music.

UET VII, 126 = *Nabnītu* xxxii

Figure 1. Block from a temple to the Aten at Karnak showing two blindfolded musicians, ca 1400 BC.

Although the illustration on the previous page does not come from Mesopotamia, but from Ancient Egypt, and dates from the middle of the first millennium BC, it is highly significant as it suggests the underlying theory, on account of its string layout, of a musical system of oral tradition, from fourth millennium Sumer.

The large lyre which stands between the two players has nine strings, a meaningful number to Mesopotamian music theory. The blind-folded musicians play facing each other in symmetrical concertation. The instrument would also have been tuned in symmetry and anhemitonically, probably as f-g-a-c-d-c-a-g-f, with D as axis of symmetry, because this kind of tuning would have lessened the risks of dissonances when two blind musicians improvise together, on the same instrument.

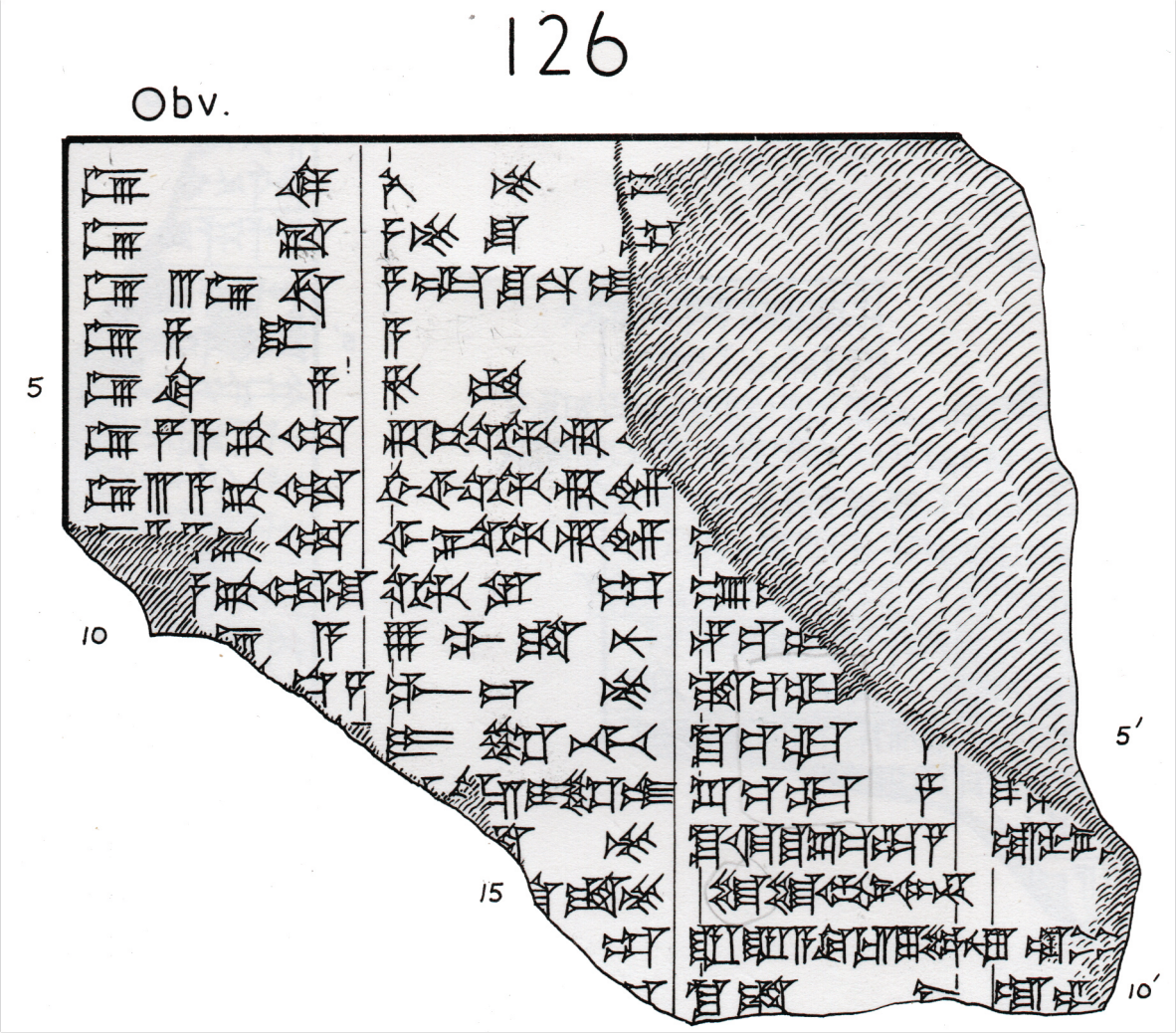


Figure 2, Professor Gurney's copy of UET VII, 126 = *nabnītu* xxxii. Columns 1 and 2. The tablet appears in *Ur Excavations Texts. Publications of the joint expedition of the British Museum and of the University Museum of the University of Pennsylvania, Philadelphia, to Mesopotamia*. Volume VII, Middle Babylonian Legal Documents and other Texts. Note the lacuna in L. 4 Col. 2 which was later corrected in *IRAQ* XLVI 82, note 1.

Sir Leonard Woolley[1] (1880-1960) found this fragmentary copy of the tablet at Ur in Southern Iraq, south of the main courtyard at the *Dublamaḫ* temple, in the late twenties. This tablet is Neo-Babylonian[2], about 600 BC. However, the knowledge it encapsulates is certainly much older as it describes the stringing of an archetypal pre-literate lyre fitted with nine strings, not unlike, at least in size, the model in figure 1. Although most copies of this lexical series are relatively late and date from around the middle of the first millennium BC, there is an Old-Babylonian precursor known as 'Proto-*nabnītu*', published in UET VI, 358[3], as UET VII, 126. There are also Middle-Babylonian versions dated around 1000 BC, including one damaged copy.

Although the earliest version of this text is Old-Babylonian, its structure, which is descriptive, suggests a much older origin which I would place at the dawn of literacy if not earlier, and orally transmitted, as this document suggests. It would have been the oral description made by a musician to a scribe asked to record the strings and names of the instrument, on a clay tablet.

It is the thirty-second tablet of the series *nabnītu* = UET VII, 126. Copies would have been distributed widely, during a number of centuries, possibly even millennia, in the various provinces and kingdoms of the Near and Middle-Orient as it certainly was a type of encyclopedia essential to scholarly institutions, temples and palaces.

Some essential philological remarks are essential before discussing the musicological significance of this bilingual text:

1) The Akkadian is partly but not entirely a literal translation of the Sumerian.

2) We assume that Sumerian entries are descriptive insofar as they give the names and locations for each of nine strings.

3) There appears be a tonal interrelationship between lines 1 and 5.

4) Lines 9 to 5 seem to stand in symmetry with lines 5 to 1.

5) We take *qud-mu-um*, in line 1, as the adjective *qudmû*, following the explicit writing *qud-mu-ú* in CBS 10996, meaning 'fore' rather than the noun *qudmu*, 'front'.

6) Similarly, we take *šá-mu-šu-um* to stand for the adjective *šamušû*, meaning 'adjacent', understanding Sumerian **sa-uš** as **sa-ús**, the underlying Akkadian verb being *emēdu*. *Šámu-šu-um*, is reconstructed as **sa-uš>sawuš** with /w/ as a glide. The /w/ is written with phonograms containing /m/ from the Old-Babylonian Period onward[4].

7) We take *úḫ-ru-um* in line 9 as the adjective *uḫrû*, rather than the noun *uḫru*, 'rear' as in lines 6 to 8.

Table 3 overleaf gives various translations made by Finkel, Kilmer (first 5 lines) and Krispijn.

Lines		Sumerian	Translation	Akkadian	Translation
l.1	a)	**sa.di**	String D	*qud-mu-⌜um⌝*	prime? string
	b)	**di.iš.šú**	first	*qud-mu-ú*	first
	c)	**sa.sá (=DI)**	'rival' string	*qud-mu-⌜um⌝*	front? string
l.2	a)	**sa.úš**	adjacent string	*ša-mu-šu-um*	adjacent (string)
	b)	**me.in**	second	*šá-mu-ši*	second
	c)	**sa.úš**	next string	*ša-mu-šu-um*	next string (loan word from Sumerian **sa.úš**
l.3	a)	**sa.3.sa.sig**	string 3 string thin	*šá-al-šu qa-a ⌜t-nu⌝*	third (string) thin
	b)	**e.šà**	third	*šál-šu qa-at-nu*	third (string) thin
	c)	**sa.3.sa.sig**	string 3 string thin	*šá-al-šu qa-at-nu*	third (string) thin
l.4	a)	**sa.4.tur**	string 4 small	**A-DÙ**	Ea-*banû* Ea-the creator
	b)	**lam.ma**	fourth	*a-ba-nu*	Ea-*banû* Ea-the creator
	c)	**sa.4.tur**	string 4 small	*<dᵏ>-a.* [**dú**]	Ea-the creator
l.5	a)	**sa.di* 5**	string **DI** 5	*ḫa-am-*[*šu*]	fifth (string)
	b)	**ia**	fifth	*ḫa-an-*[*šu*]	fifth
	c)	**sa.sá (=DI).5!**	fifth 'rival' string	*ḫa-am-*[*šu*]	fifth (string)
l.6	a)	**sa.4.a.ga.gul**	string 4 rear	*ri-bi úḫ-ri*[*im*]	fourth of the rear (string)
	b)				
	c)	**sa.4.a.ga.gul**	fourth string of the bigger back	*ri-bi úḫ-ri*[*im*]	fourth of the back (string)
l.7	a)	**sa.3.a.ga.gul**	string 3 rear	*šal-ši úḫ-ri-im*	third of the rear (string)
	b)				
	c)	**sa.3.a.ga.gul**	third string of the bigger back	*šal-ši úḫ-ri-im*	third of the back (string)
l.8	a)	⌜**sa.2.a.ga**⌝**.gul**	string 2 rear	*ši-ni úḫ-ri-im*	second of the rear (string)
	b)				
	c)	⌜**sa.2.a.ga**⌝**.gul**	second string of the bigger back	*ši-ni úḫ-ri-im*	second of the back (string)
l.9	a)	[**sa.1**]. ⌜**a**⌝**.ga.gul.la**	string 1 rear	*úḫ-ru-um*	rear (string)
	b)				
	c)	[**sa.1**]. ⌜**a**⌝**.ga.gul.la**	first string of the bigger back	*úḫ-ru-um*	back (string)
l.10	a)	**9** ⌜**sa**⌝**.a**	9 strings	*9 pi-it-nu*	9 strings
	b)				
	c)	**9** ⌜**sa**⌝**.a!**	there are 9 strings	*9 pi-it-nu*	9 strings

Figure 3. a) Finkel; b) Kilmer; c) Krispijn.

Theo J.H. Krispijn[5] translated the Sumerian lines 6, 7 and 8: **sa.x.a.ga.gul**, and string 9: **[sa.1]a.ga.gul.la** by: 'string x of the bigger back' and 'first string of the bigger back'.

The four last string names have **a.ga.gul.(la)** '(of) the bigger back' of the *sammû* instrument which names the strings at the back of the instrument by opposition to the first string which would be placed closest to the head of typical boviform lyres.

Thus strings four, three, two and one of the instrument would be placed at its 'bigger back', Since the only known instrument having a 'bigger back/bottom' is the monumental boviform lyre or other lyres with other animals such as calves, and deer, it makes little doubt that the *sammû* was the monumental boviform lyre known from the middle of the third millennium BC and probably earlier. This suggests that this instrument remained a paradigm during the next millennia until it faded away in the late first millennium BC, and later in other cultures. This text was not only a list of strings with which the instrument was strung, but it also implied the status for a fundamental transformational generative enneatonic system which was realised with UET VII, 74.

This text should be considered an Akkadian-Sumerian bilingual document as opposed to the older Sumerian-Akkadian lexical series. However, UET VII, 126 stands apart from other Akkadian-Sumerian vocabularies because the Akkadian is partly but not entirely a literal translation of the Sumerian. These entries are not prescriptive. They are descriptive

as they name and locate the nine strings of the lyre. Sumerian lines 9 to 5 stand in symmetry with lines 5 to 1 while Akkadian entries indicate variations to the symmetry of the Sumerian.

Then, the reader may ask why the first two strings in Sumerian and Akkadian are not simply called 'string 1' and 'string 2'. What is the meaning of 'small', 'thin' and 'Ea-the creator', and why the first line has **sa.di** without '1' while the fifth line has **sa.di** with, we think '5'. What is the meaning of **sa.di**? These writings cannot encapsulate some extraordinary or unintelligible system. However, they can be explained musicologically. As we will see, the third and fourth strings give a clear indication about the transition from anhemitonism to hemitonism. The third 'thin' string has a parallel with the *akakoba*[6], also meaning 'thin string' which is found on a harp from Uganda with a similar function and position as the thin string in the present text and with the *pien*[7]*/quilisma/stropha*[8].

Structuralism

According to Claude Lévi-Strauss[9], cultures are viewed as systems which are analysed in terms of structural relations among their elements. Thus, patterns in cultural systems, of which musical systems are part, are products of the fabric of the human mind.

The original layout of the earliest systems came from the yoke of the monumental lyre. It is a linear structure, a straight and slender wooden stick, on which strings are affixed at precise emplacements and tuned by means of levers, or other methods, to satisfy the cultural sphere with which they identify.

This leads to the hypothesis that the descriptive enneachordal listing of the strings of the lyre was also underlying the tuning method within the structure of the transformational hypersystemic enneatonic pitch set described with figures 4, 5 and 6.

1) String 5, (D) being the centre of the system would have been tuned to a pitch which satisfied the lyricist in relation of the structure of the instrument.

2) From this central pitch, string 1 of the treble would be tuned up to a fifth (A).

3) From the same central pitch, string 1 of the bass would be tuned down to a fifth (G).

4) From both first strings (treble and bass) the fourth strings (treble and bass) would be tuned up and down to a fourth (E and C).

5) From the centre, string 5, two fourths would be projected to the treble and to the bass, generating an anhemitonic enneatonic: A-G-x-E-D-C-x-A-G.

6) From (C) tune (F) and from (E) tune (B), generating an hemitonic enneatonic A-G-F-E-D-C-B-A-G.

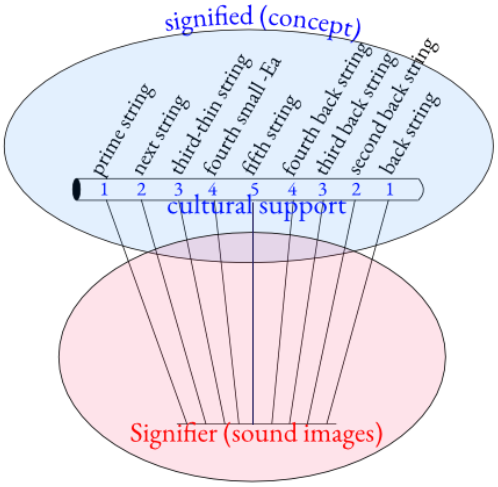


Figure 4. The construction of the lyre described in UET VII, 126 as a cognitive process.

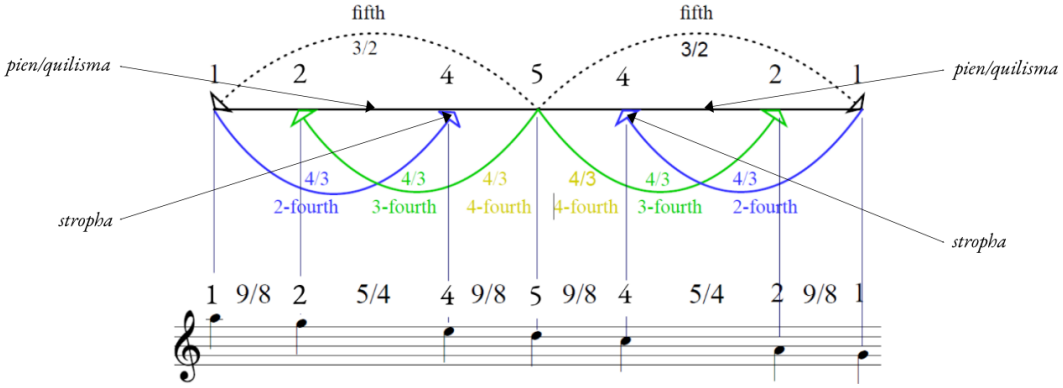


Figure 5. Graphic representation of the hypersystemic anhemitonic pentatonic construction which excludes f (*pien/quilisma)* and b (*pien/quilisma*), the Procrustean interval generated by their later inclusion as semitonal inclusion, as extrapolated from UET VII, 126. For the quantification of pitches and intervals, see pages 85-92.

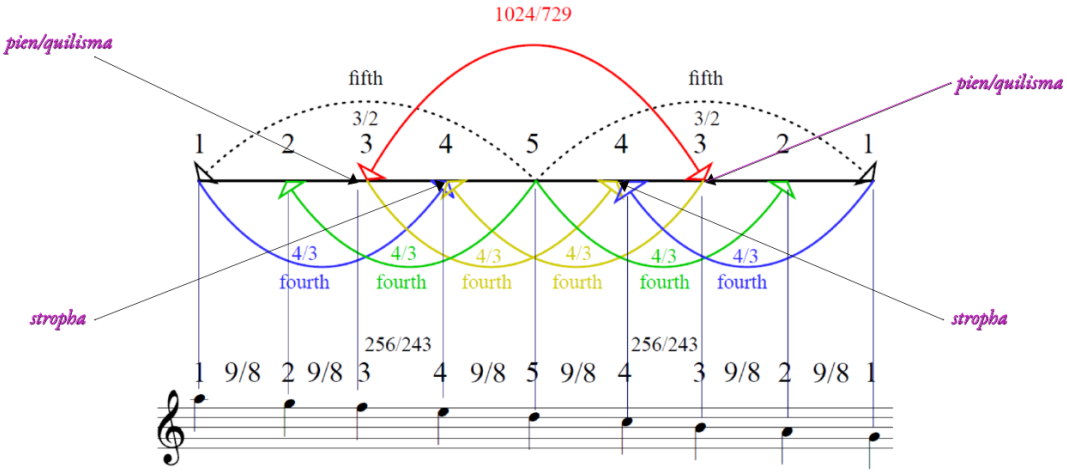


Figure 6. Graphic representation of the transformative hypersystemic hemitonic enneatonic construction as extrapolated from UET VII, 126. For the quantification of pitches and intervals, see pages 85-92.

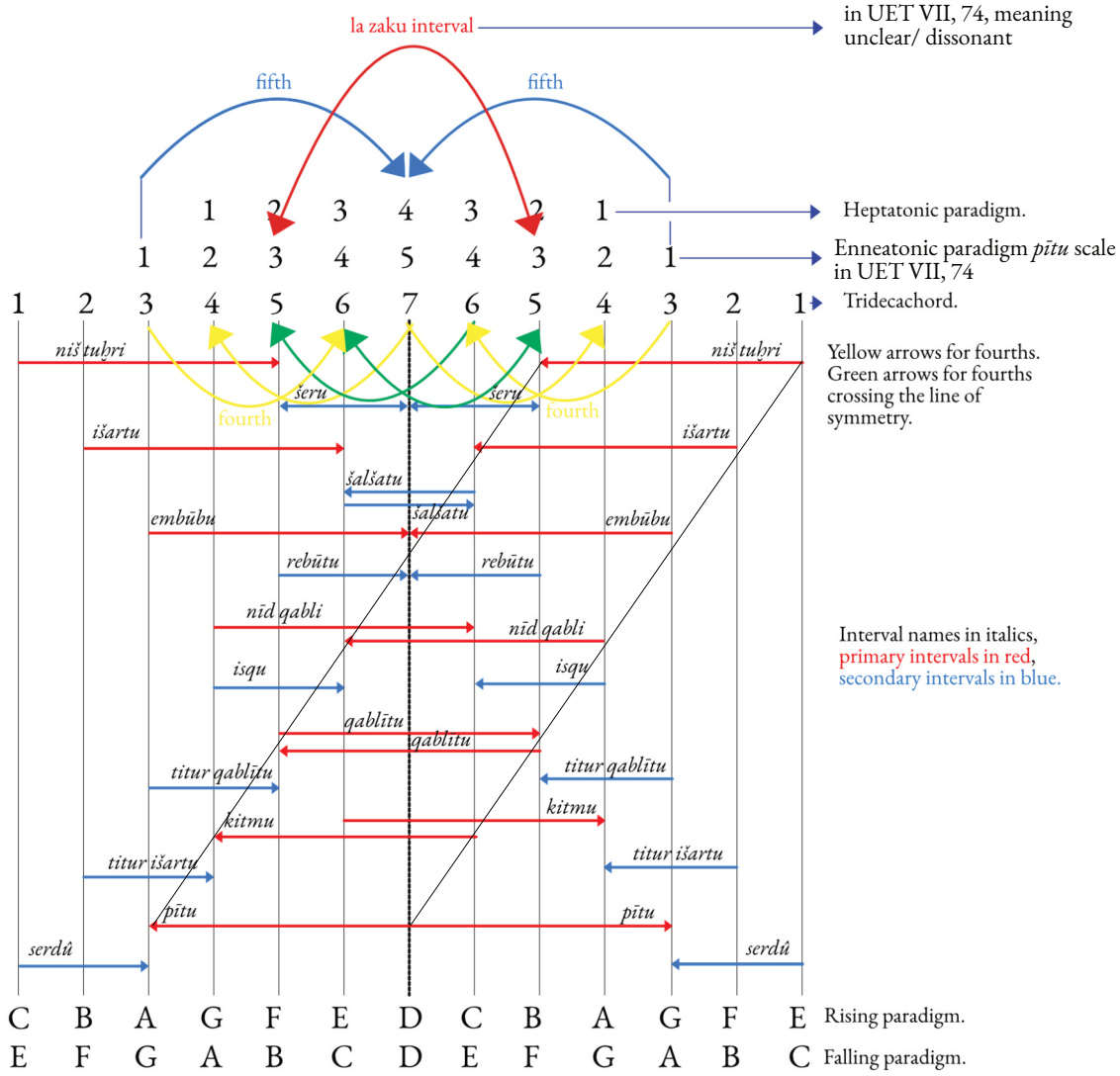


Figure 7. Schematic representation the symmetric structure of the forerunner of proto-CBS 10996 to which the structures of UET, VII, 126 and UET VII, 74 are superimposed. For the quantification of pitches and intervals, see pages 85-92.

Now, all of this, at present, as shown above, would remain hypothetical as it would rely only on our elucidation of CBS 10996, which rests on our understanding of UET VII, 126. However, the superimposition of our evaluation of UET VII, 74, as an enneatonic system, sits at the centre with the scale of *pītum* (A-G/G-A) which appropriately means 'opening'. It is the transformative generative scale, having interval *qablītu* meaning 'middle' precisely sitting at the middle of that scale on degree 3 (*pien/quilisma*) of the front and degree 3 (*pien/quilisma*) of the behind (F-B/B/F). This is a perfect example of systemic symmetry.

This proves the evidence of an elusive proto CBS 10996 text which hosted a series of seven falling fifths and of seven rising thirds, or reciprocally.

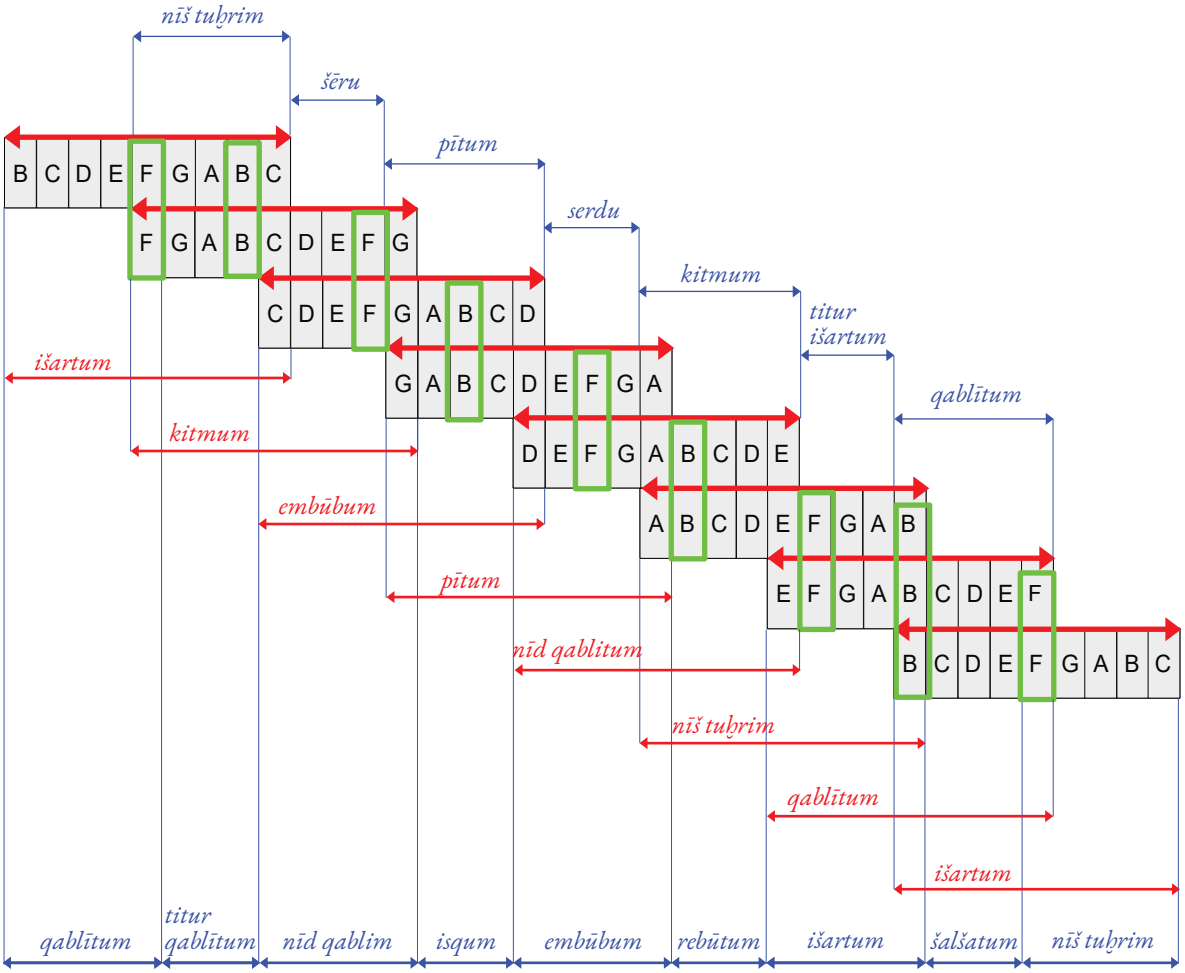


Figure 8. Complete intervallic and scalar construction within proto-CBS 10996. Scales in red; intervals in blue. Red arrows indicating the polarity of the scales. Note the *piena/quilismata/strophica* in green rectangles.

Endnotes

[1] Woolley, L., (Sir Charles), *UR EXCAVATIONS, I and II*, *Joint Expedition of the British Museum and of the Museum of the University of Pennsylvania to Mesopotamia*. (1927).

[2] Throughout this book I use the terms Old-Babylonian/Assyrian, Middle-Babylonian/Assyrian and Neo-Babylonian/Assyrian, and others, to define the different orthographies/epigraphy of these texts. I do not intend to identify historical periods associated to these orthographic/epigraphic variations.

[3] *Ur Excavation Text*, Volume VI, plate 358, Published by British Museum Publications Limited.

[4] Von Soden 1995, *GAG* §21d

[5] Forthcoming.

[6] Trowell, Margaret and Wachsmann, Klaus, Tribal Crafts of Uganda, *American Anthropologist*, Volume 59, Issue 1, (Feb. 1957), pp. v-viii, 1-198.

[7] The word *pien* comes from the Chinese language and is used for the two notes which transform the traditional pentatonic scale into a diatonic scale. See Yasse, Joseph, *A Theory of Evolving Tonality*. American Library of Musicology (1932), p.34.

[8] Saulnier, Dom Daniel, *Gregorian Chant, a guide to the history and liturgy*, translated by Dr. Mary Berry, CBE. Paraclete Press (2017), p. 55.

[9] Lévi-Strauss, C., *Structural Anthropology*, trans. Claire Jacobson and Brooke Grundfest Schoepf, New York: Basic Books, (1963).

N. 4782

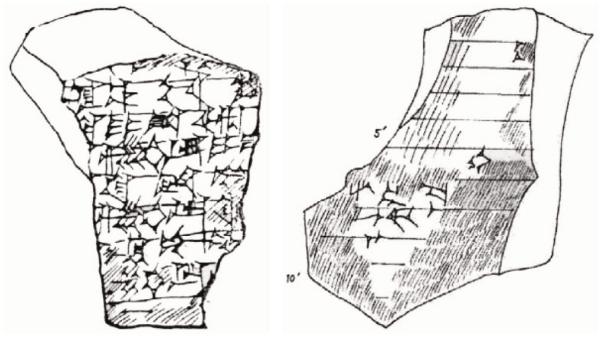


Figure 1. Hand copies of N. 4782. Reverse, left by Shaffer. Obverse, right by Miguel Civil.

In November 1977, Aaron Shaffer found a small fragment in the University Museum collection in Philadelphia which he thought that it complemented UET VII 126. It was published in 1981[1].

Obverse

Line	Sumerian column	Akkadian column
1' (i8)	[x x x x]	*š*[*i*]-*n*[*i*] *ú*[*ḫ-re-em*]
2' (i9)	[x x x x]**.la**	*úḫ-ru-*[*um*]
3' (i12)	[x x]**.sa 2**	*i-ša-ar-*[*tum*]
4' (i13)	[x x x x x]	*sí-ḫi-ip i-š*[*a-ar-ti-im*]
5' (i14)	[x x x x x]	*ki-it-mu-*[*um*]
6' (i15)	[x x x x x]	s*í-ḫi-ip ki-i*[*t-mi-im*]
7' (i16)	[x x x x x]	*en-bu-bu-*[*um*]
8' (i17)	[x x x x x	*s*]*í-ḫ-ip e*[*n-bu-bi-im*]

Reverse

Line	Sumerian column	Akkadian column
1'- 4' broken or undeciphered traces		
5'	[x x x x	x x x] *a* [xx]
6'	[x x x x	x x x x] *ḫi*-x [x]
7'	[x x x x	x x x x x x]
8'	[x x **giš al**].**gar**	x x[x x x]
9'	[x x x	x]x *ti*-x-[x x x]
10'	[x x x x]x	[x x x x x]
rest broken		

UET VII 126, Obv. Col.I & 2, NB. + N. 4782, Obv. OB.?

1. **sa.di**	*qud-mu-u*[*um*]	[**sa.di**	*qud-mu-u-um*]
2. **sa.uš**	*šá-mu-šu-um*	[**sa.uš**	*šá-mu-šu-um*]
3. **sa.3.sa.sig**	*ša-al-šu qa-a*[**t-nu**]	[**sa.3.sa.sig**	*ša-al-šu qa-at-nu*]
4. **sa.4.tur**	*a-ba-nu-*[*ú*]	[**sa.4.tur**	*a-ba-nu-ú*]
5. **sa.di*5**	*ḫa-am-*[*šu*]	[**sa.di*5**	*ḫa-am-šu*]
6. **sa.4.a.ga.gul**	*ri-bi úḫ-ri-i*[*m*]	[**sa.4.a.ga.gul**	*ri-bi úḫ-ri-im*]
7. **sa.3.a.ga.gul**	*šal-ši úḫ-ri-rim*	[**sa.3.a.ga.gul**	*šal-ši úḫ-ri-rim*]
8. **sa.2.a.ga.gul**	*ši-ni úḫ-ri-im*	1’ [**sa.2.a.ga.gul**]	*ši-ni ú*[*ḫ-ri-im*]
9. [**sa.1**]**a.ga.gul.la**	*úḫ-ru-um*	2’ [**sa.1.**]**a.ga.gul**].**la**	*úḫ-ru-um*
10. [**9**]**sa.a 9**	*pi-it-nu*		
11. [**sa.**]**du.a!**	*pi-is-mu*		
12. [**sa. si.s**]**á**	*i-šar-ti*	3’ [**sa.si**].**sá**	*i-ša-ar-*[*tum*]
13. [**sa.x si.sá**]	[*s*]*i-ḫ-ip i-šar-tum*	4’ [**sa.x sa.s**]**á**	*si-ḫi-ip i-š*[*a-ar-tim*]
14. [**sa.šu?**]	[*ki-i*]*t-mu*	5’ [**sa.š**]**u?**	*ki-it-mu-*[*um*]
15. [**sa.x šu?**]	[*si-ḫi-ip k*]*i-it-mu*	6’ [**sa.x š**]**ú?**	*si-ḫi-ip ki-*[*it-mi-im*]
16. [**sa.gi.gíd**]	[*em-bu-bu*]*-um*	7’ [**sa.gi.g**]**íd**	*em-bu-bu-*[*um*]
17. [**sa.x.gi.gíd**]	[*si-ḫi-ip em-bu-bu-u*]*m*	8’ [**sa.x.gi.gíd**]	*si-ḫi-ip e*[*n-bu-bi-im*]
18. [**sa**.x]	[*pi-tum*]	9’ [**sa**.x]	[*p*]*i-*[*tum*]
19. [**sa**.x y]	[*siḫip pitim*]	10’ [**sa**.x y]	[*siḫip pitim*]
20. [**sa.šub.murub**$_4$]	[*nīd qablim*]	11’ [**sa.šub.murub**$_4$]	[*nīd qablim*]
21. [**sa**.x.**šub.murub**$_4$]	[*siḫip nīd qablim*]	12’ [**sa**.x.**šub.murub**$_4$]	[*siḫip nīd qablim*]
22. [**sa**.x.**gaba.ri**]	[*niš tuḫrim*]	13’ [**sa**.x.y.**gaba.ri**]	[*nīš tuḫrim*]
23. [**sa**.x.y.**gaba.ri**]	[*siḫip niš tuḫrim*]	14’ [**sa**.x.y.**gaba.ri**]	[*siḫip nīš tuḫrim*]
24. [**sa**.x.**murub**$_4$]	[*qablītum*]	15’ [**sa**.x.**murub**$_4$]	[*qablītum*]
25. [**sa**.x.y.**murub**$_4$]	[*siḫip qablītum*]	16’ [**sa**.x.y.**murub**$_4$]	[*siḫip qablītim*]

Figure 2. Transliteration of UET VII, 126, Obv. Col. I and II, NB. + N. 4782, Obv., OB.?

N. 4782 is certainly a fragment which would be the continuation of UET VII, 126. It comes from a copy of the same text. It would be a second ‘chapter’, as after having listed the nine string-pitches of the system ending by saying ‘nine strings’, the text continues with line 11: (Sumerian)[**sa**.]**du**.**a!** (Akkadian) *pi-is-mu*, as a header? But what is the meaning of *pismu*? The *CAD* is inconclusive as it says nothing more than we already know. An enlightened guess, on the basis of our interpretation of lines 12 (= 3’), to 25 (=16’) is that *pismu* would be the term for step-melodic fifth’, and that with regard *siḫip*, *siḫpum* would be a nominal derivative of *saḫapum*, ‘to throw to the ground’. However, for reasons which will become obvious during the process of our explanations, we would translate the verb *saḫapum* not as ‘to throw to the ground’, but ‘to send back to the begining’ the designated step-melodic fifth at the beginning of the next scale. As explained before, an enneatonic scale is made up of two conjoined step-melodic fifths and we propose that lines 12 (= 3’), to 25 (=16’) give the name of the second fifth of a scale, and secondly that the instruction

(*siḫip*) means to replace it at the beginning of the next scale where it is followed by a second fifth, thus creating a new scale, and so forth. Therefore these lines explain the formation of enneatonic scales and confirm that each is made up of two conjoined melodic fifths. Prior to illustrating the process, let us be reminded of the structures of the scales:

Interval names in red and scale names in blue.

Fifths *nīš tuḫrim* + *qablītum*	= pitch set of *išartum*	= c-b-a-g-f-e-d-c-b
Fifths *qablītum* + *išartum*	= pitch set of *qablītum*	= f-e-d-c-b-a-g-f-e
Fifths *išartum* + *kitmum*	= pitch set of *nīš tuḫrim*	= b-a-g-f-e-d-c-b-a
Fifths *kitmum* + *embūbum*	= pitch set of *nīd qablim*	= e-d-c-b-a-g-f-e-d
Fifths *embūbum* + *pītum*	= pitch set of *pītum*	= a-g-f-e-d-c-b-a-g
Fifths *pītum* + *nīd qablim*	= pitch set of *embūbum*	= d-c-b-a-g-f-e-d-c
Fifths *nīd qablim* + *nīš tuḫrim*	= pitch set of *kitmum*	= g-f-e-d-c-b-a-g-f

and lines 3' to 16' of N 4782

Line12	*išartum*
Line13	*siḫip išartim*
Line14	*kitmum*
Line15	*siḫip kitmim*
Line16	*embūbum*
Line17	*siḫip embūbim*
Line18	*pītum*
Line19	*siḫip pītim*
Line 20	*nīd qablim*
Line 21	*siḫip nīd qablim*
Line 22	*nīš tuḫrim*
Line 23	*siḫip nīš tuḫrim*
Line 24	*qablītum*
Line 25	*siḫip qablītim*

Description of the *siḫip* process from lines 3 to 16 of N. 4782:

Fifths are given in red, scales in blue to avoid confusion since scales and fifths have the same names.

išartum	f-e-d-c-b-a-g-f-e	scale of *qablītum*
siḫip išartim (*išartum* to the front)	b-a-g-f-e-d-c-b-a	scale of *nīš tuḫrim*
kitmum	b-a-g-f-e-d-c-b-a	scale of *nīš tuḫrim*
siḫip kitmim (*kitmum* to the front)	e-d-c-b-a-g-f-e-d	scale of *nīd qablim*
embūbum	e-d-c-b-a-g-f-e-d	scale of *nīd qablim*
siḫip embūbim (*embūbum* to the front)	a-g-f-e-d-c-b-a-g	scale of *pītum*
pītum	a-g-f-e-d-c-b-a-g	scale of *pītum*
siḫip pītim (*pītum* to the front)	d-c-b-a-g-f-e-d-c	scale of *embūbum*
nīd qablim	d-c-b-a-g-f-e-d-c	scale of *embūbum*
siḫip nīd qablim (*nīd qablim* to the front)	g-f-e-d-c-b-a-g-f	scale of *kitmum*
niš tuḫrim	g-f-e-d-c-b-a-g-f	scale of *kitmum*
siḫip niš tuḫrim (*niš tuḫrim* to the front)	c-b-a-g-f-e-d-c-b	scale of *išartum*
qablītum	c-b-a-g-f-e-d-c-b	scale of *išartum*
siḫip qablītim (*qablītum* to the front)	f-e-d-c-b-a-g-f-e	scale of *qablītum*

Conclusion

N. 4782 is elucidated from our interpretation of text CBS 10996 applied to the enneatonic system on an ambitus of the 15 degrees of an hypersystemic pentadecachordal, span from c3 to c5. We note that Akkadian does not differentiate names of intervals from names of scales, as is made clear from this text and others. In the present text, from lines 3 to 16 terms apply to intervals and not to scales as is clearly demonstrated in the table above. Fifths are moved from one end of a scale to the beginning of the other and so forth thus generating a chain of coherent scales.

The description suggests a tuning procedure which differs from that which is prescribed in text UET VII, 74 where the tuning process is undertaken by means of the correction of the dissonant interval or Procrustean fifth, in the scale, identified as *la zaku* (unclear), to consonance, by tensing or relaxing one or two strings of the lyre thus creating a new scale. The process is continued until the cycle concludes with a scale having the same name as the first scale mentioned, *išartum*, however, a semitone higher as a consequence of the process used. This will be explained later in the chapter on UET VII.

Endnotes

[1] Shaffer, Aaron. A New Musical Term in Ancient Mesopotamian Music, *IRAQ* XLIII, Part I, spring (1981), pp. 79-83; Kilmer, A., and Crocker, R. The Fragmentary Text from Nippur, *IRAQ* XLVI (1984), 81-85.

UET VII, 74 = U.7/80

Figure 1. Cast of UET VII, 74. Photograph by the author, with courtesy of the Trustees of the British Museum.

Introduction

The conflation of the present document with text CBS 10996 (pp.67-80) and Hurrian song H.6 (pp.93-96) in the same spacio-temporal sphere has been one, if not the most opinionated of posteriorisms[1] in the history of musicology. Certain Assyrio-musicologists took text CBS 10996, written in the middle of the first millennium, for the elucidation of UET VII, 74, although the former being distant from the latter by at least 1,200 years and furthermore, felt pertinent to decode the music of Hurrian song H.6, written 800 years before. Leaving aside chronological inconsistencies, these texts differ in their purpose. CBS 10996 is descriptive, UET VII, 74 is transformative generative prescriptive, while H.6 is a musical composition[2].

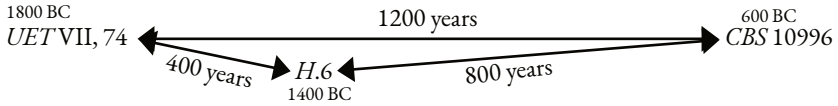


Figure 2. Chronology of the three texts with different musicological purposes

Text CBS 10996, which is the most recent of the three comes from the middle of the first millennium BC. It is descriptive. It is a list of 7 primary and 7 secondary intervals located by the numbers of a 7 degree grid. Additionally to their numbers, each of the 14 intervals have a name the meaning of which yet unclear to Assyriology. What is clear is that these intervals were an adaptation of an earlier larger system since some of the intervals listed needed to be inverted in order to fit within a smaller heptatonic grid. Thus, CBS 10996 is a snapshot of intervals as they would have stood from the middle of the first millennium onward.

The second text, UET VII, 74, which is Old-Babylonian, about 1800 BC, is prescriptive transformative generative. It is a method by which to modify some degrees in a given scale to generate another. For that purpose, it uses interval locations and names from the list in CBS 10996. However, these intervals being limited to a grid of 7 degrees would be insufficient for the needs of the instructions in UET VII, 74 which require 9 degrees. Therefore, these texts are incommensurable.

As there are no known lists of intervals dating from the Old-Babylonian period, we undertook a reconstruction of CBS 10996 based on the correction of its inverted intervals by means of extrapolation. This ended up with a list spreading onto 13 degrees, or a 'pseudo CBS 10996'. However this tridecachord includes both primary (falling fifths) and secondary (rising thirds) intervals while the transformative prescriptive generative prescriptions in UET VII, 74 requires only 7 primary intervals (descending fifths) which spread onto a hendecachord. Now, UET VII, 74 in its current status is designed for 9 pitches generating 8 enneatonic scales. However, this span is insufficient because, as a consequence, two of its intervals remain inverted. The instructions require 11 degrees to host its 8 scales without any intervallic inversion. This strongly suggests that there had been a Sumerian hendecatonic forerunner of UET VII, 74, agreeing with the 11 strings on the silver lyre of Ur, for example.

H.6 dates from around 1400 BC. It is a song as unequivocally written on the colophon. There is no mention of any accompanying instrument. Therefore we take it was a syllabic monody, or a song where each syllable has its own degree. The relation of this text to the two preceding is that it uses both primary and secondary stepwise melodic intervals in proto CBS 10996 and their transformation through the instruction in UET VII, 74.

Sources

Apart from a small flake which is probably a fragment from another contemporary tablet, archaeology has not produced any other duplicate. However, the presence of this flake, as coincidental it may be, would suggest that this manuscript was well-known during the Old-Babylonian Period. There would have been a Sumerian predecessor, contemporary with the boviform lyres of Ur, which is yet to be discovered.

It was unearthed by Sir Leonard Woolley[3] at Ur in the nineteen-twenties. Professor Gurney published it some forty years later, in 1968[4]. At that time no one had yet thought that the scale might be descending[5] and in spite of my attempts at promoting the idea on the basis of Greek, Oriental and other models, we were ignored. After having asked advice from David Wulstan[6] Music Master at Magdalen, Oxford, Gurney published his paper, taking the system as if it were ascending. Then, in 1982, the Syrian Raoul Gregory Vitale[7] also advanced that the system was descending but was likewise ignored. Finally, in 1990, Assyriologist colleague and friend Th.J.H. Krispijn[8] perceived a new reading of line 12 as *nusu-ḫ*[*um*, a form of the verb *nasāḫum*, 'to tighten'. This new term *nasāḫum*, Sumerian **gíd.i**, or *nussuḫum*, Sumerian **zi.zi**, is the technical verb for 'to tighten' strings. Its antonym is *ne'ûm*, Sumerian **tu.lu.** Subsequently Gurney published another paper in 1994 which concluded that the Babylonian system was descending. Assyriologists did not trust musicology and it was only on philological grounds that some admitted that the system was descending.

A reminder of UET VII, 126

N.B. Since intervals and scales have the same names, intervals are in red and scales in blue.

The structure of text UET VII, 126 which was discussed earlier, consists in the nomenclature of the degrees of a static enneatonic scale where the degrees are organised in a symmetrical pattern. This scale would have been used as a standard from which to build other scales with chains of thirds, amounting to what is called a system. It is composed of two conjoined (step)melodic fifths: *embūbum* and *pītum* or a-g-f-e-d and d-c-b-a-g, (which are themselves composed of two conjoined thirds[9]), respectively, amounting to a scale known as *pītum* meaning 'opening', an appropriate term from which to construct a system. On account of its symmetrical structure, the pitches would be a-g-f-e-d-c-b-a-g. In the text, the string/pitches are defined as follows: [**sa.di**; **sa.úš**; **sa.3.sa.sig**; s**a.4.tur**; **sa.di.5**] and [**sa.di.5**; **sa.3.a.ga.gul**; **sa.2.a.ga.gul**; **sa.1.a.ga.gul.la**], roughly meaning: first string; second string, third thin string; fourth small string Ea-creator; fifth string; fourth rear string; third rear string; second rear string and rear string. This can be simplified as: 1f-2f-3f-4f-5-4r-3r-2r-1r, where superscripted suffix 'f' indicates '(string)-of the front', and superscripted suffix 'r' indicates '(string)-of the rear'. This arrangement is critical for the understanding of the present text.

The right column

The tablet is badly damaged with its four sides broken away. We note that it is divided into two columns. The text was restored by means of extrapolation on the basis that line 12 appeared to be the axis from which lines 11 and 13 flowed oppositely in symmetry. The instructions in this text are set in quatrains.

As we shall see, the static scale standard in UET VII, 126, and the transformational generative prescription in UET VII, 74 are linear diatonic and enneatonic. They validate each other. Without the symmetric nature of the instructions given in the two quatrains sitting on each side of the axis of symmetry at line 12, it would have been impossible to say how the text started or finished. It was on the basis that the first fifth (1-5) in CBS 10996 being *niš tuḫrim*, (c-b-a-g-f) taken in its descending disposition, that we hypothesised that UET VII, 74, too, would have started with this falling interval of the fifth which conjoined with the fifth *qablītum* amounted to the scale of *išartum*. It must be noted that the scale of *pītum*, or 'opening' scale remains at the centre of the system from which, prior to the design of UET VII, 74, it would have grown symmetrically to generate hypersystems. This indicates that different transformational generative methods were used at different periods.

Thus, we uphold that UET VII, 74 gives instructions for the construction of a series of eight descending enneatonic scales sharing the names of the seven fifths as we know them in my reconstruction of a proto-CBS 10996.

UET VII, 74 is further evidence of the remarkable creative genius of Babylonian scholarship. The transformative generative method prescribed in this system was never equalled by any other civilisation as it transforms a dynamic[10] disposition into its thetical[11] form by means of a transformative correction of dissonance.

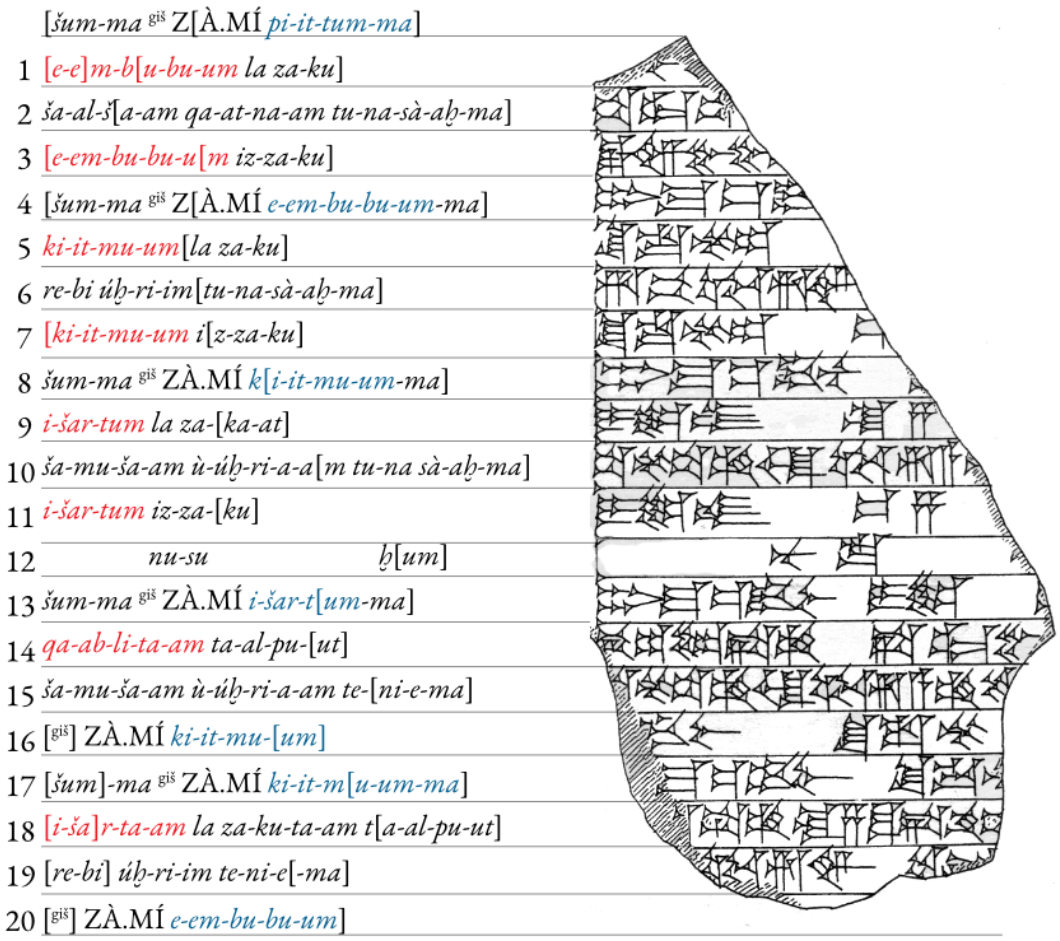


Figure 3. Professor Oliver Gurney's hand copy of the right column.

This text presents a combination of the following: 1) Each quatrain starts with a conjunction introducing a conditional clause, the protasis, and finishes with an implied apodosis: 'if...then'. 2) It mentions a string instrument, the **ZÀ.MÍ**. 3) It gives the names of intervals as they are known from text CBS 10996. 4) It mentions the names of nine strings as they are known from UET VII, 126. 5) There are instructions for the tension and, or, relaxation of strings. 5) They include terms in the negative and in the positive, qualifying an interval (*la zaku* and *iz-za-ku* = clear and unclear, that we would take as the adjective *zakû*). Since there are 9 string/pitches listed, this confirms that the instructions in the text were related to the 9 strings listed in UET VII, 126, and not to the heptatonic configuration in CBS 10996.

Therefore this text is about an instrument fitted with nine strings and with instructions for the construction of the 8 scales of an enneatonic system.

Rightly, some will argue that there should be a distinction between span and system. However, the instructions apply to all nine strings, systemically, and is therefore evidence of their application for an enneatonic scale system and that the usage of an enneachordal

instrument was mainly illustrative of the span required. Had the text been dedicated to a heptatonic system, then only seven string would have sufficed. The instructions would have been adapted accordingly.

Gurney's transliteration of the tablet in its current status:

[*šum-ma* ^{giš} Z[À.MÍ *pi-it-tum-ma*]
[*e-e*]*m-b*[*u-bu-um la za-ku*]
ša-al-š[*a-am qa-at-na-am tu-na-sà-aḫ-ma*]
[*e-em-bu-bu-u*[*m iz-za-ku*]

[*šum-ma* ^{giš} Z[À.MÍ *e-em-bu-bu-um-ma*]
ki-it-mu-um[*la za-ku*]
re-bi úḫ-ri-im[*tu-na-sà-aḫ-ma*]
[*ki-it-mu-um i*[*z-za-ku*]

šum-ma ^{giš} ZÀ.MÍ *k*[*i-it-mu-um-ma*]
i-šar-tum la za-[*ka-at*]
ša-mu-ša-am ù-úḫ-ri-a-a[*m tu-na sà-aḫ-ma*]
i-šar-tum iz-za-[*ku*]

nu-su-ḫ[*u-um*]

šum-ma ^{giš} ZÀ.MÍ *i-šar-t*[*um-ma*]
qa-ab-li-ta-am ta-al-pu-[*ut*]
ša-mu-ša-am ù-úḫ-ri-a-am te-[*ni-e-ma*]
[^{giš}] ZÀ.MÍ *ki-it-mu-*[*um*]

[*šum*]*-ma* ^{giš} ZÀ.MÍ *ki-it-m*[*u-um-ma*]
[*i-ša*]*r-ta-am la za-ku-ta-am t*[*a-al-pu-ut*]
[*re-bi*] *úḫ-ri-im te-ni-e*[*-ma*]
[^{giš}] ZÀ.MÍ *e-em-bu-bu-um*]

Figure 4. Professor Oliver Gurney's hand copy of the right column. [Text in square brackets are reconstructions]

However, it will be noted that last lines of the quatrains in the second part differ from the last lines in the quatrains in the first part. In the first part the last line says that the *la zaku* Procrustean intervals are corrected to consonance (*e-em-bu-bu-um iz-za-ku*) while the last line of the second part mentions the issuing scale (^{giš}ZÀ.MÍ *e-em-bu-bu-um*). Let us remember that the corrected interval in the first part has the same name as the generated scale in the second.

Prior to our demonstration, it is indispensable to explore the structure of the enneatonic scale system. The table below has been extrapolated from UET VII, 126, from our reconstruction of proto CBS 10996, and from the transformative generative prescriptions in UET VII, 74:

Part 1

Thetic fifths *niš tuḫrim + qablītum*	= set of *išartum*	=	c-b-a-g-f-e-d-c-b
Dynamic fifths *niš tuḫrim + qablītum*	= set of *išartum*	=	c-b-a-g-f-e-d-c-b
Thetic fifths *qablītum + išartum*	= set of *qablītum*	=	c-b-a-g-f#-e-d-c-b
Dynamic fifths *qablītum + išartum*	= set of *qablītum*	=	f-e-d-c-b-a-g-f-e
Thetic fifths *išartum + kitmum*	= set of *niš tuḫrim*	=	c#-b-a-g-f#-e-d-c#-b
Dynamic fifths *išartum + kitmum*	= set of *niš tuḫrim*	=	b-a-g-f-e-d-c-b-a
Thetic fifths *kitmum + embūbum*	= set of *nīd qablim*	=	c#-b-a-g#-f#-e-d-c#-b
Dynamic *kitmum + embūbum*	= set of *nīd qablim*	=	e-d-c-b-a-g-f-e-d
Thetic fifths *embūbum + pītum*	= set of *pītum*	=	c#-b-a-g#-f#-e-d#-c#-b
Dynamic fifths *embūbum + pītum*	= set of *pītum*	=	a-g-f-e-d-c-b-a-g
Thetic fifths *pītum + nīd qablim*	= set of *embūbum*	=	c#-b-a#-g#-f#-e-d#-c#-b
Dynamic fifths *pītum + nīd qablim*	= set of *embūbum*	=	d-c-b-a-g-f-e-d-c
Thetic fifths *nīd qablim + nīš tuḫrim*	= set of *kitmum*	=	c#-b-a#-g#-f#-e#-d#-c#-b
Dynamic fifths *nīd qablim + nīš tuḫrim*	= set of *kitmum*	=	g-f-e-d-c-b-a-g-f
Thetic fifths *niš tuḫrim + qablītum*	= set of *išartum*	=	c#-b#-a#-g#-f#-e#-d#-c#-b#
Dynamic fifths *nīš tuḫrim + qablītum*	= set of *išartum*	=	c-b-a-g-f-e-d-c-b

Part 2

Thetic fifths *niš tuḫrim + qablītum*	= set of *išartum*	=	c#-b#-a#-g#-f#-e#-d#-c#-b#
Dynamic fifths *nīš tuḫrim + qablītum*	= set of *išartum*	=	c-b-a-g-f-e-d-c-b
Thetic fifths *nīd qablim + nīš tuḫrim*	= set of *kitmum*	=	c#-b-a#-g#-f#-e#-d#-c#-b
Dynamic fifths *nīd qablim + nīš tuḫrim*	= set of *kitmum*	=	g-f-e-d-c-b-a-g-f
Thetic fifths *pītum + nīd qablim*	= set of *embūbum*	=	c#-b-a#-g#-f#-e-d#-c#-b
Dynamic fifths *pītum + nīd qablim*	= set of *embūbum*	=	d-c-b-a-g-f-e-d-c
Thetic fifths *embūbum + pītum*	= set of *pītum*	=	c#-b-a-g#-f#-e-d#-c#-b
Dynamic fifths *embūbum + pītum*	= set of *pītum*	=	a-g-f-e-d-c-b-a-g
Thetic fifths *kitmum + embūbum*	= set of *nīd qablim*	=	c#-b-a-g#-f#-e-d-c#-b
Dynamic *kitmum + embūbum*	= set of *nīd qablim*	=	e-d-c-b-a-g-f-e-d
Thetic fifths *išartum + kitmum*	= set of *niš tuḫrim*	=	c#-b-a-g-f#-e-d-c#-b
Dynamic fifths *išartum + kitmum*	= set of *niš tuḫrim*	=	b-a-g-f-e-d-c-b-a
Thetic fifths *qablītum + išartum*	= set of *qablītum*	=	c-b-a-g-f#-e-d-c-b
Dynamic fifths *qablītum + išartum*	= set of *qablītum*	=	f-e-d-c-b-a-g-f-e
Thetic fifths *niš tuḫrim + qablītum*	= set of *išartum*	=	c-b-a-g-f-e-d-c-b
Dynamic fifths *niš tuḫrim + qablītum*	= set of *išartum*	=	c-b-a-g-f-e-d-c-b

Figure 5. Author's reconstruction of the (almost) palindromic enneatonic 8 scales in UET VII, 74. Thetical disposition in red italics, dynamical disposition in black regular.

It is also important to be reminded that the '*la zaku*' 'unclear Procrustean fifths' are located at the following positions in the 8 enneatonic scales:

In *išartum*,	the fifth *qablītum* is '*la zaku*'.	It is placed on 5 - 1 rear
In *qablītum*,	the fifth *nīš tuḫrim* is '*la zaku*'.	It is placed on 1front - 5
In *nīš tuḫrim*,	the fifth *nīd qablim* is '*la zaku*'.	It is placed on 4 front - 2 rear
In *nīd qablim*,	the fifth *pītum* is '*la zaku*'.	It is placed on 3 rear - 4 front
In *pītum*,	the fifth *embūbum* is '*la zaku*'.	It is placed on 3 front - 3 rear
In *embūbum*,	the fifth *kitmum* is '*la zaku*'.	It is placed on 4 rear - 3 front
In *kitmum*,	the fifth *išartum* is '*la zaku*'.	It is placed on 2 front - 4 rear
In *išartum*,	the fifth *qablītum* is '*la zaku*'.	It is placed on 5 - 1 rear

Figure 6. Position of the *la zaku* (Procrustean fifths) intervals in the eight scales of the first part of UET VII, 74.

Explanation of the transformational generative prescriptions in the first part of UET VII, 74

First quatrain
I If the **ZÀ.MÍ** is *išartum* (*nīš tuḫrim* + *qablītum*) (c-b-a-g-f-e-d-c-b)(c-b-a-g-f-e-d-c-b).
II The 'unclear interval' is *qablītum* (f-e-d-c-b).
III Tighten string 5.
IV *qablītum* will be clear = (f#-b) = (f#-b).

Second quatrain
I If the **ZÀ.MÍ** is *qablītum* (*qablītum* + *išartum*) = (c-b-a-g-f♯-e-d-c-b)(f-e-d-c-b-a-g-f-e).
II The 'unclear interval' is *nīš tuḫrim* = (f-e-d-c-b).
III Tighten strings 1of the front and string 2 of the rear.
IV *nīš tuḫrim* will be clear = (c#-f#) = (f#-b).

Third quatrain
I If the **ZÀ.MÍ** is *nīš tuḫrim* (*išartum* + *kitmum*) = (c♯-b-a-g-f♯-e-d-c♯-b)(b-a-g-f-e-d-c-b-a).
II the 'unclear interval' is *nīd qablim* (f-e-d-c-b).
III tighten string 4 of the front.
IV *nīd qablim* will be clear = (g#-c#) = (f#-b).

Fourth quatrain
I If the **ZÀ.MÍ** is *nīd qablim* (c#-b-a-g#-f#-e-d-c#-b)(e-d-c-b-a-g-f-e-d).
II the 'unclear interval' is *pītum* (the text says 3r-4f). We note that in l*a zaku* (unclear) interval is atypical as its inverted and is located from the third string of the rear to the fourth string of the front and is reduced to a fourth b-f. This inversion is meaningful as it suggests that the system was larger that the enneachord.
III tighten string 3 of the rear.
IV *pītum* will be clear = (g#-d#) = (b-f#).

Fifth quatrain
I If the **ZÀ.MÍ** is *pītum* (c#-b-a-g#-f#-e-d#-c#-b) (a-g-f-e-d-c-b-a-g).
II the 'unclear interval' is *embūbum* (f-e-d-c-b).
III tighten string 3 of the front.
IV *embūbum* will be clear = (a#-d#) = (f#-b).

Sixth quatrain
I If the **ZÀ.MÍ** is *embūbum* (c#-b-a#-g#-f#-e-d#-c#-b) (d-c-b-a-g-f-e-d-c).
II The 'unclear interval' is *kitmum* (fourth string of the rear and third string of the front) (f-b).We note that the *la zaku* (unclear) interval is atypical as its inverted and located from the fourth string of the rear to the third string of the front and is reduced to a fourth (f-b). This second inversion reinforces my suggestion that the system was larger that the enneachord and that this inversion was an adaptation of a larger system to an enneatonic system. Let us remember that this method was already used with text CBS10996.
III Tighten string 4 of the rear.
IV *kitmum* will be clear = (a#-e#) = (b-f#)

Seventh quatrain
I If the **ZÀ.MÍ** is *kitmum* (c#-b-a#-g#-f#-e#-d#-c#-b) (g-f-e-d-c-b-a-g-f).
II The 'unclear interval' is *išartum* second string of the front and fourth string of the rear.
III Tighten string 2 of the front and 1 of the rear.
IV *išartum* will be clear = (b#-e#) = (f#-b).

Line 12 reads *nu-su-ḫ*[*u-um*] and instructs that the whole process from the first part must be reversed.

The intervallic inversions, from fifths to fourths, in quatrains four and six clearly indicate that the enneachord was not wide enough for the system without these inversions and that therefore, in a precursory status, the ambitus would have spanned a hendecachord as confirmed from our reconstruction of CBS 10996 which lists the seven step-melodic fifths on a span of 11 degrees.

Thus, we may conclude that prior to the Old-Babylonian period, organology would take us to the mid-third millennium, between the Early Dynastic First Dynasty of Ur and the First Dynasty of Lagash, when lyres were most popular, as we know from the iconography, when they were fitted with the greatest number of strings. However, the silver lyre of Ur at the British Museum appears to have had nine strings originally and that its span was then increased to eleven around 2600 BC, at the time of its inhumation. This is shown by the marks of oxidation left by the silver tuning levers on the yoke and by the marks the strings have left on the soil where the instrument was laid to rest. It is contended that string 1 at the rear and string 11 at the middle of the yoke were later additions. The reason is that the first string of the rear would never have been set outside of the trapezoidal framework of the instrument. As for the last string, it would have been set at the exact centre of the yoke while it is placed slightly to the right on the Silver Lyre of Ur. Both first and last strings on this lyre suggest an increase from 9 to 11 strings having taken place around 2600 BC.

Note that in the first part, scholars who believe that UET VII, 74 was a heptatonic text used the list of intervals as they are laid out in CBS 10996, a text, we shall remind the readers that was written 1400 years after UET VII, 74 was conceived. Therefore, it will not come as a surprise that this manipulation would have turned UET VII, 74 into a heptatonic system. As a consequence of this anachronism, in the First Part second quatrain, the third line should read ' tune up 1 of the front and 2 of the rear' and not 1 and 8. Fourth quatrain, the third line should read 'tune up 3 of the rear' and not 7. Seventh

Second quatrain, third line should read 'tune down 4 of the rear' and not 6. Fourth quatrain, the third line should read 'tune 3 of the rear' and not 7. Sixth quatrain, the third line should read 'tune down 1 of the front and 2 of the rear' and not 1 and 8.

The diagrams overleaf shows the locations of the seven primary intervals, firstly in a mid-first millennium heptatonic layout; secondly in a second millennium enneatonic layout and thirdly in an hendecatonic layout of the fourth/third millennia.

In figure 7, the heptatonic layout shows that intervals *nīd qablim*, *qablītum*, *kitmum* and *kitmum* have been inverted into fourths to fit within the heptachordal span.

In figure 8, the enneatonic layout shows that the intervals *kitmum* and *kitmum* have been inverted into fourths to fit within the enneachordal span.

In figure 9, all the intervals remain fifths.

Figure 10. The author and British Museum assistant removing the Silver lyre of Ur for further inspection. Note the position of the rear string located outside the trapezoidal frame of the instrument, and the treble string which is not located at the middle of the yoke but about 10 centimetres to the right of the centre.

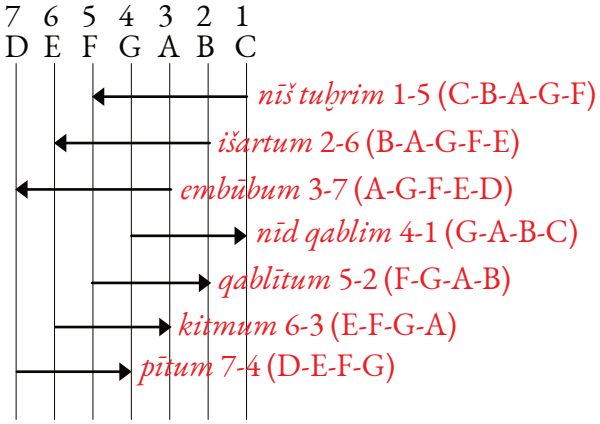


Figure 7. Heptatonic layout. 3 fifths are descending the four last are inverted into fourths because of the reduced span. The tonal axis has shifted by a fifth to the bass.

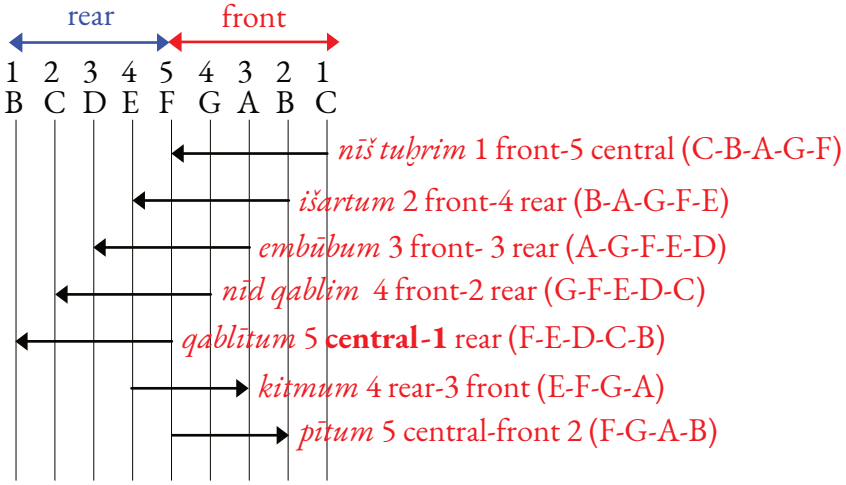


Figure 8. Enneatonic layout. 5 fifths are descending the two last are inverted into fourths because of the reduced span. The tonal axis has shifted by two tones to the bass.

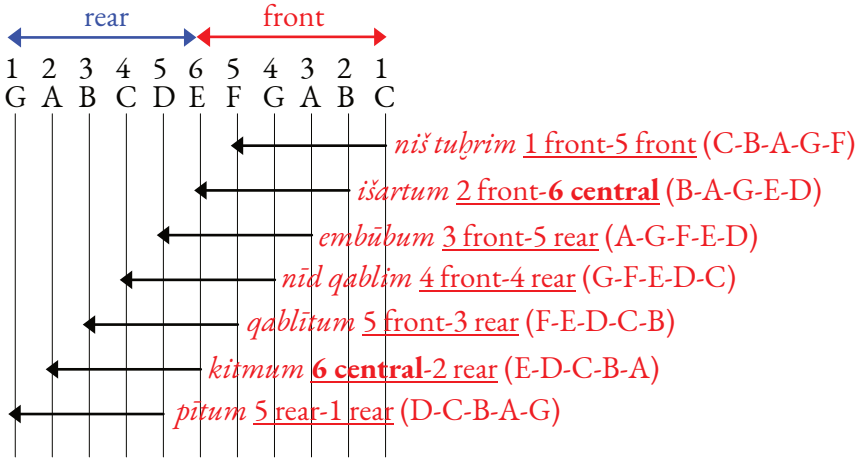


Figure 9. Hendecatonic layout. All fifth are descending. The tonal axis has shifted by one tone to the bass.

Reconstruction of the full transformational generative prescriptions in UET VII, 74

First Part

1. When **zami** *išartum*
qablītum unclear
tune up 5
qablītum clear

2. When **zami** *qablītum*
niš tuḫrim not clear
tune up 1 of the front and 2 of the rear
niš tuḫrim clear

3. When **zami** *niš tuḫrim*
nīd qablim unclear
tune 4 of the front
nīd qablim clear

4. When **zami** *nīd qablim*
pītum unclear
tune up 3 of the rear
pītum clear

5. When **zami** is *pītum*
embūbum unclear
tune up 3 of the front
embūbum clear

6. When **zami** is *embūbum*
kitmum unclear
tune up 4 of the rear
kitmum clear

7. When the **zami** is *kitmum*
išartum unclear
tune up 2 of the front and 1 of the rear
išartum clear

8. When **zami** *išartum*
qablītum unclear...

Second Part

1. When **zami** *išartum*
qablītum unclear
tune down 2 of the front and 1 of the rear
zami is *kitmum*

2. When **zami** *kitmum*
išartum unclear
tune down 4 of the rear
zami is *embūbum*

3. When **zami** *embūbum*
kitmum unclear
tune down 3 of the front
zami is *pītum*

4. When **zami** *pītum*
embūbum unclear
tune down 3 of the rear
zami is *nīd qablim*

5. When **zami** *nīd qablim*
pītum unclear
tune down 4 of the front
zami is *niš tuḫrim*

6. When **zami** *niš tuḫrim*
nīd qablim unclear
tune down 1 of the front and 2 of the rear
zami is *qablītum*

7. When **zami** *qablītum*
niš tuḫrim unclear
tune down 5
zami is *išartum*

8. When **zami** *išartum*
qablītum unclear...

Hendecatonic thetical scaling

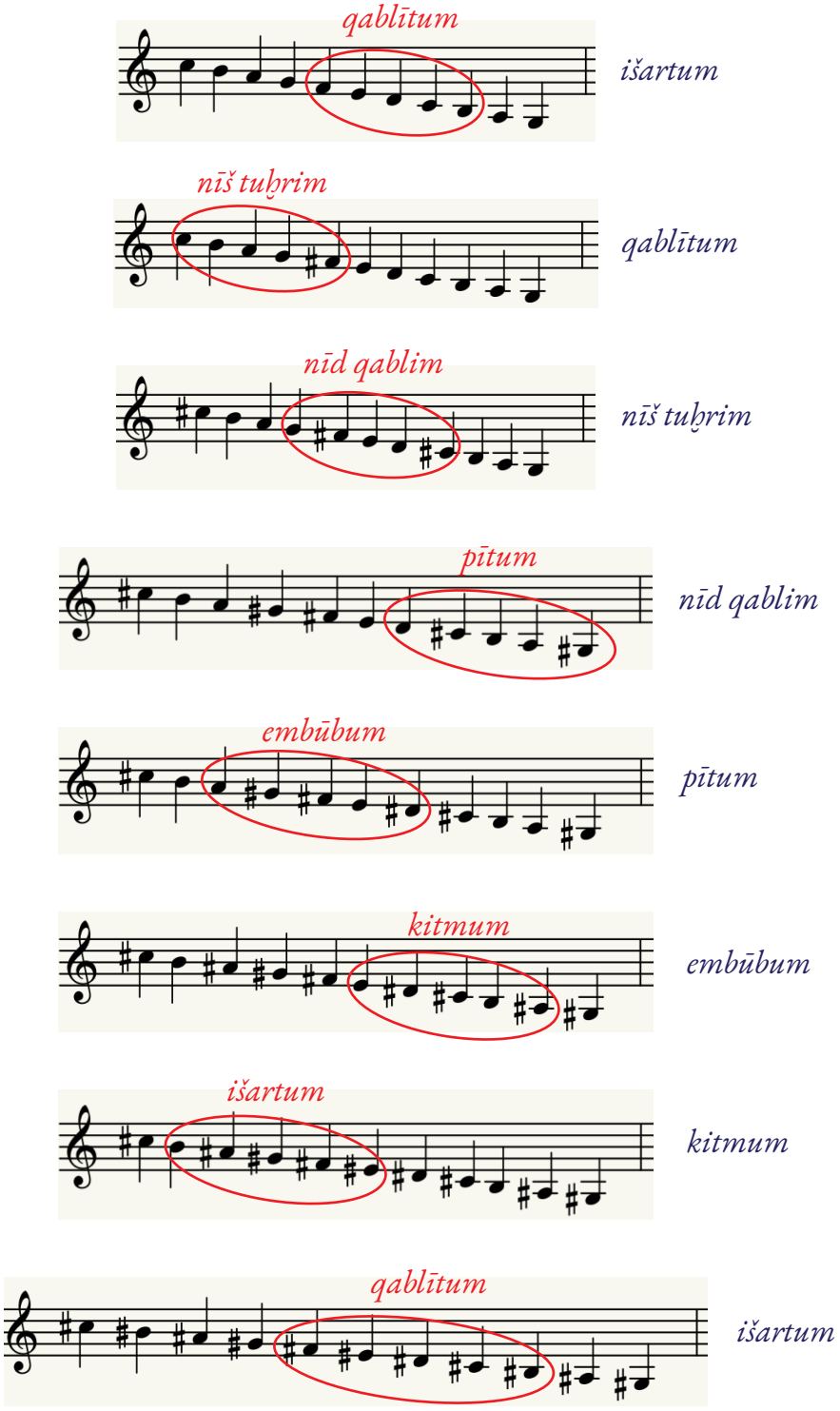


Figure 11. Hendecatonic thetical scaling.

Thetical notation Enneatonic scaling Dynamic notation

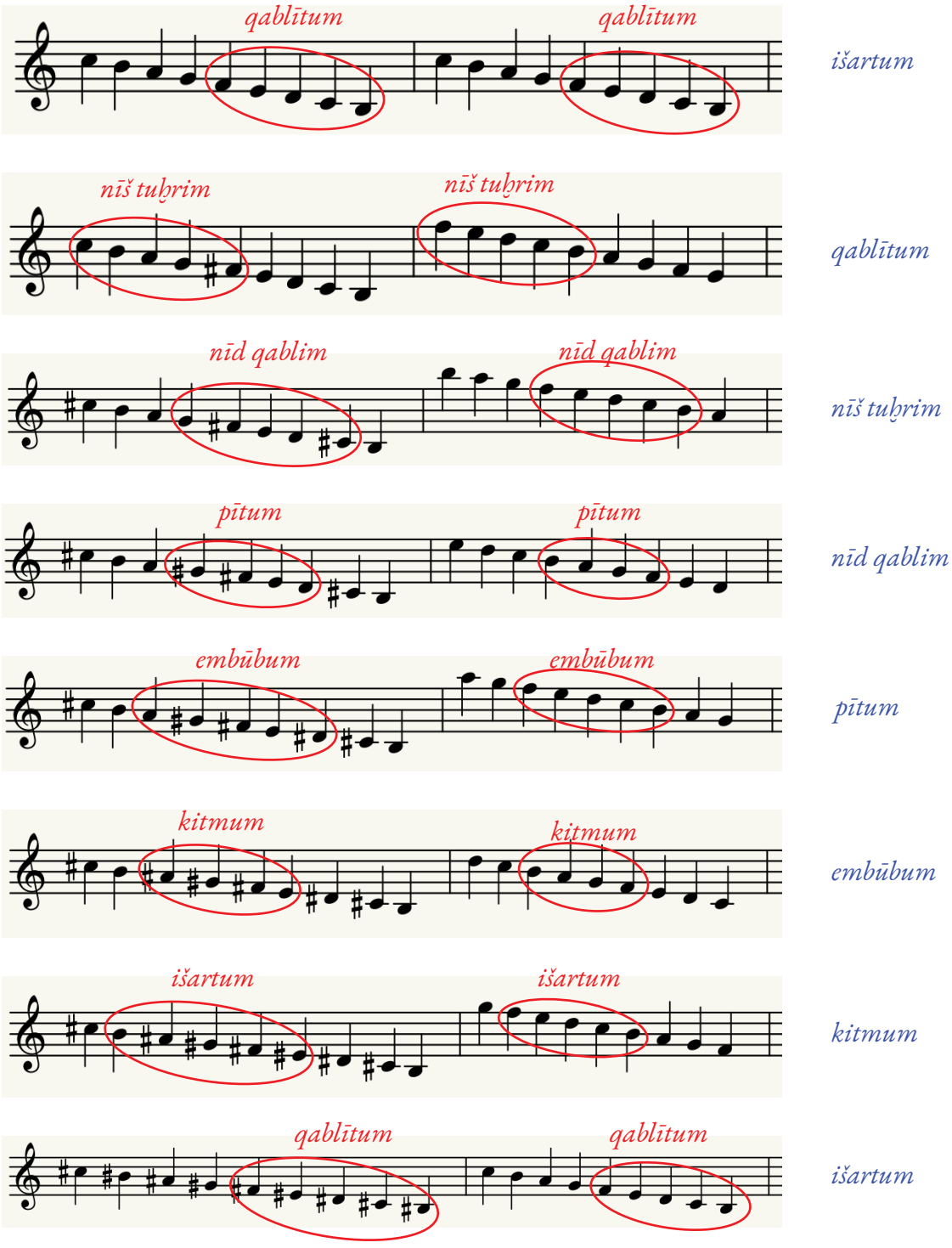


Figure 12. Enneatonic thetical and dynamic scaling.

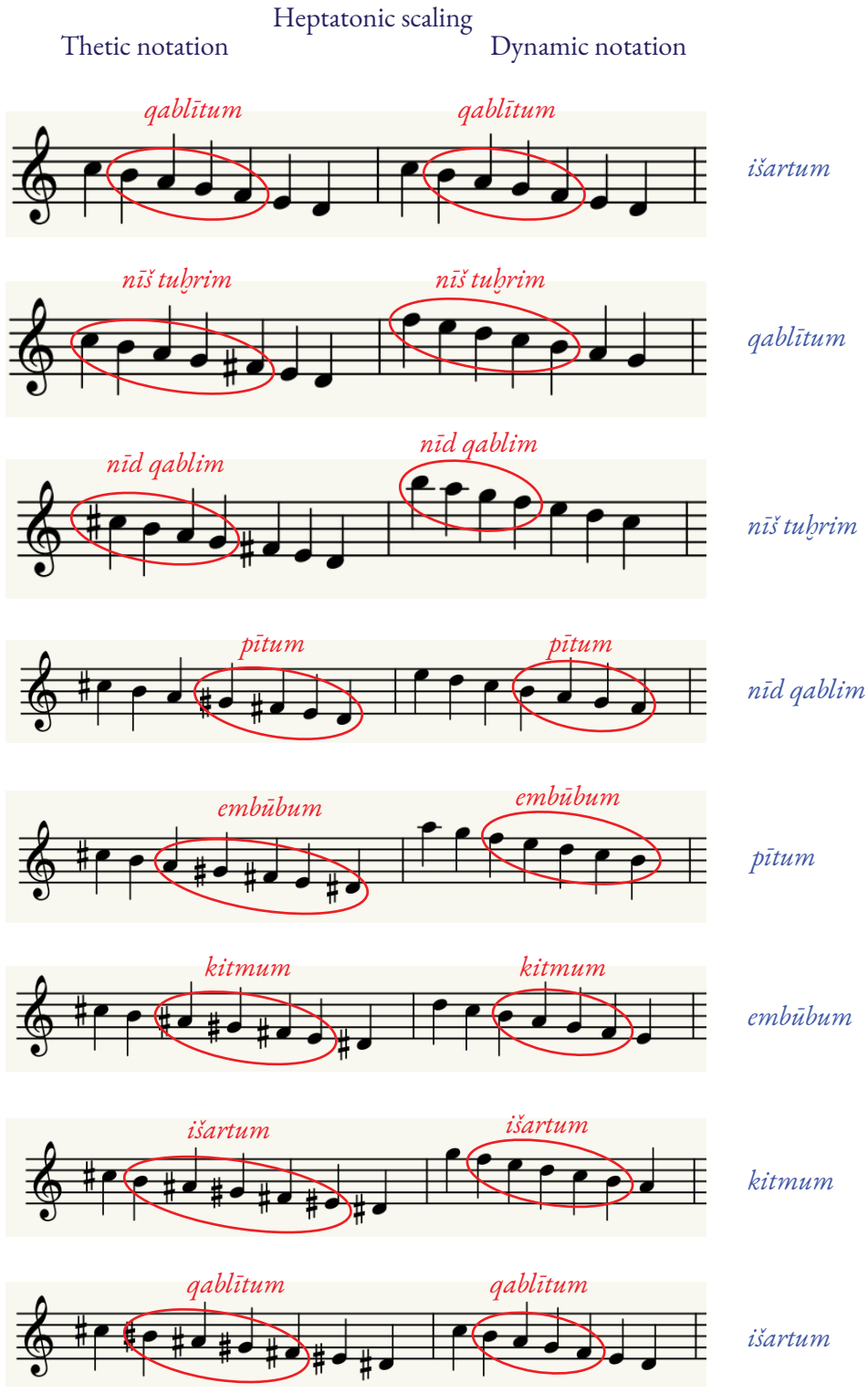


Figure 13. Heptatonic thetical and dynamic scaling.

We contend that the instructions in UET VII, 74 were never used outside the theoretical scene and probably never applied in practice. The reason is that while transposing a scale to a contiguous one would have been simple enough, for instance from *qablītum* to *niš tuḫrim* one would only have needed to tune up two Cs to two C sharps, but the tuning from *išartum* to *kitmum* would have required the sharpening of six pitches, taking a relatively long time, perhaps by as much as one minute per alteration, to which the stabilisation of the instrument would have added. We would be in favour of the usage of a unique dynamic tuning which would have allowed for the playing in most scales, or of a smaller ambitus allowing for the playing in few scales depending on the span of the instrument, taking in account, additionally that the melodic span of songs, in Antiquity, might have rarely extended more than a fifth. It is also probable that during a performance, religious or profane, it would be reasonable to assume that a particular specific scale would have been chosen and remained the same throughout the performance. After all was this not the case with the Suite de Dances in the 17th and 18th centuries. Therefore, we contend that UET VII, 74 was, after all, a text of theory devised for theoreticians and not for practice. Musicians would have been mostly illiterate and the memorising of the instructions in UET VII, 74 would have been arduous to them. When literacy was rare, texts of theory destined to musicians, would have to be as simple as possible. This is why our interpretation of CBS 10996 would have been the simplest representation of a 'Greater Babylonian System' that any musician would have understood without any academic instruction in music theory, just remembering the names of intervals and the corresponding pitch series, as with Maqamian *ajnas*. Thus, we are confident in that CBS 10996, in our interpretation, had been an orally transmitted system long before it was committed to clay tablets.

The left column

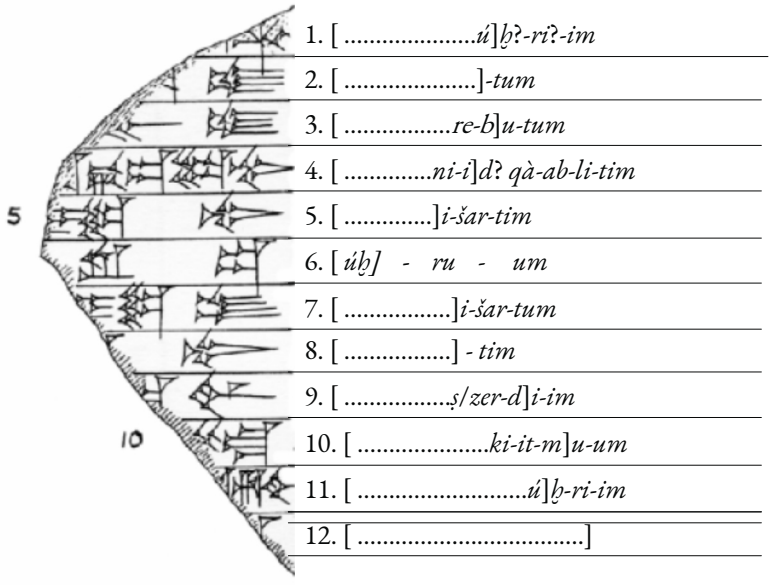


Figure 14. UET VII, 74, left column.

In the left column of UET VII, 74, lines 1, 6 and 11 must refer to three rear strings (4, 3 and 2) since the '*uḫru*' is in the genitive and that only in these three strings '*uḫru*' can be in the construct state: *ri-bi úḫ-ri-im*; *šal-ši úḫ-ri-im* or *ši-ni úḫ-ri-im*: fourth string 'of the rear'; third string 'of the rear'; second-string 'of the rear'. At line 6, we take *úḫ-ru-um* as the adjective *uḫrû*, rather that the noun *uḫru*, 'rear'.

The other terms refer to interval names known from CBS 10996. Line 2 has the nominative (*t*)*-um*, and could be either *išartum*, *šalšatum*, *rebūtum* or *qablītum*, with intervals 2-6, 8-6, 9-7 and 5-9 respectively. Line 3 ending with *b*]*u-tum* could only belong to *rebūtum* 9-7. Line 4, *qà-ab-li-tim* in the genitive implies that it is preceded by *titur* meaning 'bridge'. The intervals could either be 4-8, or 11-9. In line 5 *išartim* could be preceded by *titur* since it is in the genitive, interval 12-10. Line 7 has *išartum* in the nominative, interval 2-6. Line 8 ending with a genitive could either be *titur qablītim* or *titur išartim*, 11-9 or 12-10. The next line, 9 with *-d*]*i-im* could either be 1-5, 4-8 or 11-9. Line 10 with its nominative ending is most likely to be 6-9.

Leaving aside the philological debate raised by the above reconstruction and relying only on musicological logic, we note that the text is made up of quatrains, as is the case with the right column of the same tablet. However, on this column, quatrains are subtitled with pitch-string names arranged in descending fifths, according to our reconstruction below.

The quatrain proceed as follows:

1) The first line is a descending step-melodic fifth.
2) The second line is an ascending step-melodic third.
3) The third line is an ascending step-melodic third.
4) The fourth line is a descending step-melodic fifth.
5) The fifth line is the name/pitch of a string.

These intervals follow a specific pattern:1-5;7-5;12-10;5-9. They represent intervals which are written in full as they are listed from CBS 10996: 1-5 = *niš tuḫrim*; 7-5 = *šerum*; 12-10 = *titur išartim*; 5-9 = *qablītum*. Follows the subtitle, in this case: *ḫamšu* ? The next quatrain starts with the last interval ending the previous one. In this case: 5-9, interval *qablītum*. Partial reconstruction below:

1.[.....*ú*]*ḫ-ri-im*	string	5?		= D?
2.[.....*qà-ab-l*[*i-tum*	interval	5-9	b-c-d-e-f	
3.[.....*re-b*]*u-tum*	interval	11-9	g-a-b	
4.[.....*ti-tu-u*]*r qà-ab-li-tim*	interval	9-7	b-c-d	
5.[.....]*i-šar-tim*	interval	2-6	e-f-g-a-b	
6.[*úḫ*]*-ru-um*?	string	1 of rear		= G
7.[.....]*i-šar-tum*	interval	2-6	e-f-g-a-b	
8.[.....*šal-š*[*a-tim*	interval	8-6	c-d-e	
9.[*ṣ/zer-d*]*i-im*	interval	6-4	e-f-g	
10.[...*ki-it-m*]*u-um*	interval	6-10	a-b-c-d-e	
11.[....*ri-bi ú*]*ḫ-ri-im*	string	4 of rear		= C
12.[.....]	interval	6-10		

Figure 15. UET VII, 74, interpretation of string and interval positions.

Structural analysis of the system in the left column

As shown above, the system is made up of quatrains. We assume that the series started with quatrain 'A' as it starts with the interval 1-5 = *niš tuḫrim*, followed immediately by *šerum*, as we have it in CBS 10996.

It is followed by *titur išartim* and *qablītum*. This generates the following pattern:

l.e	STRING A	*qudmu*	String A
l.f	1-5	*nīš tuḫrim*	f-g-a-b-c
l.g	7-5	*šerum*	d-e-f
l.h	12-10	*titur išartim*	f-g-a
l.i	5-9	*qablītum*	b-c-d-e-f
l.1	STRING D	*ḫamšu*	String D
l.2	5-9	*qablītum*	b-c-d-e-f
l.3	11-9	*titur qablītim*	g-a-b
l.4	9-7	*rebūtum*	b-c-d
l.5	9-13 = 2-6	*išartum*	e-f-g-a-b
l.6	STRING G 1 rear	*uḫrum*	String G
l.7	2-6	*išartum*	e-f-g-a-b
l.8	8-6	*šalšatum*	c-d-e
l.9	13-11 = 6-4	*ṣ/zerdum*	e-f-g
l.10	6-10	*kitmum*	a-b-c-d-e
l.11	STRING C	*ribi uḫrim*	String C
l.12	6-10	*kitmum*	a-b-c-d-e
l.13	12-10	*titur išartim*	f-g-a
l.14	10-8	*išqum*	a-b-c
l.15	10-14 = 3-7	*embūbum*	d-e-f-g-a
l.16	STRING E	*šalšu qatnu*	String E
l.17	3-7	*embūbum*	d-e-f-g-a
l.18	9-7	*rebūtum*	b-c-d
l.19	7-5	*šerum*	d-e-f
l.20	7-11	*pītum*	g-a-b-c-d
l.21	STRING B	*šalši uḫrim*	String B
l.22	7-11	*pītum*	g-a-b-c-d
l.23	13-11	*serdu*	e-f-g
l.24	11-9	*titur qablītum*	g-a-b
l.25	4-8	*nīd qablim*	c-d-e-f-g
l.26	STRING E	A.DÙ	String E
l.a	4-8	*nīd qablim*	c-d-e-f-g
l.b	10-8 = 3-1	*išqum*	a-b-c
l.c	8-6	*šalšatum*	c-d-e
l.d	8-12 = 1-5	*nīš tuḫrim*	f-g-a-b-c
l.e	STRING A	*qudmu*	String A

Figure 16. Reconstruction of the left column of UET VII,74.

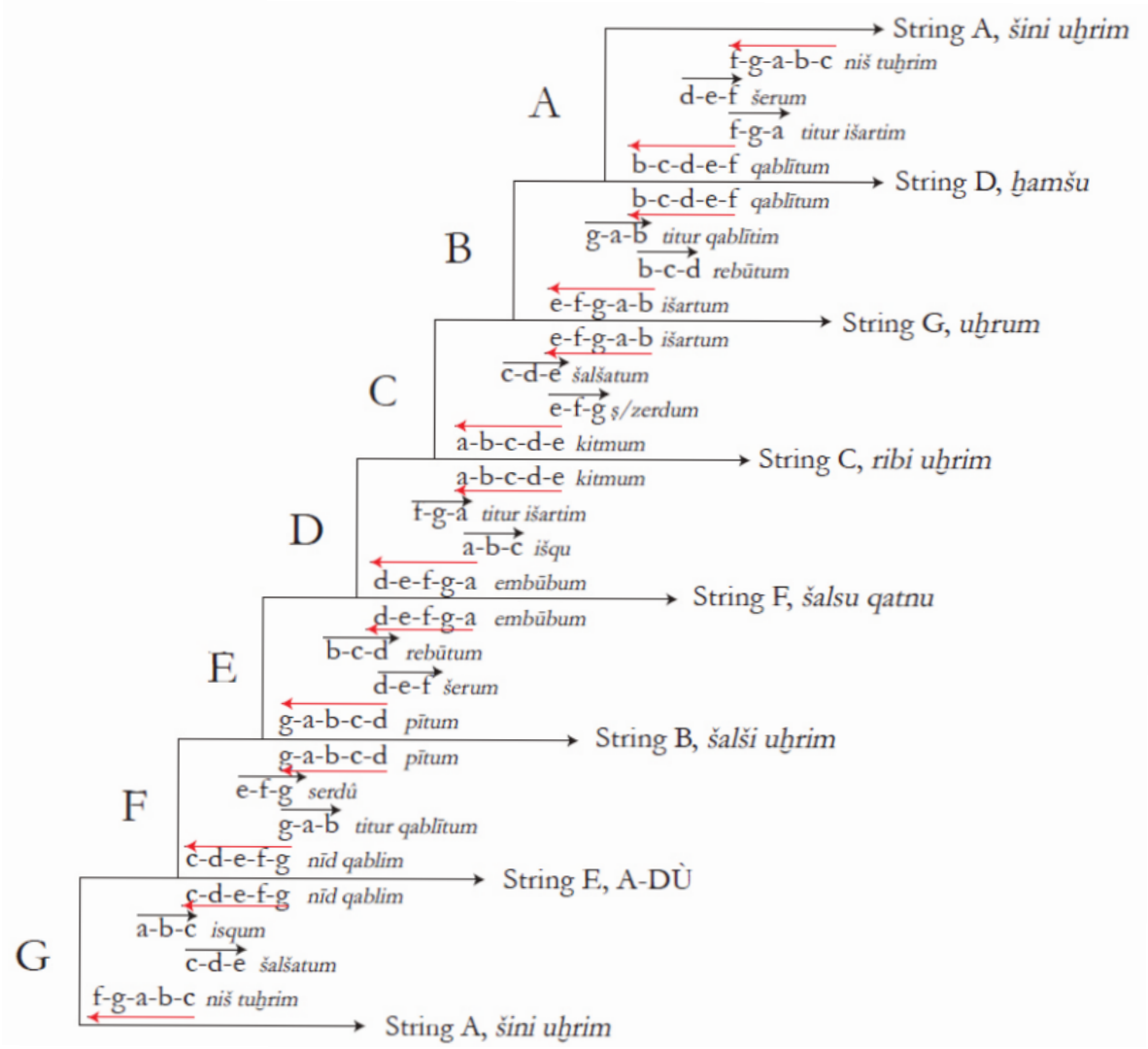


Figure 17. Schematic representation of the left column of UET VII, 74.

Observation

In our reconstruction,

1) The first quatrain, 'A',
   a) Starts with the descending step-melodic fifth *niš tuḫrim*.
   b) It is complemented with the last member of the quatrain, the descending step-melodic fifth *qablītum*.
   c) The conjoining of the two intervals amounts to the scale *išartum*.
   niš tuḫrim + *qablītum* = *išartum*. (c-b-a-g-f + f-e-d-c-b = c-b-a-g-f-e-d-c-b)
d) The next quatrain starts with the descending melodic fifth *qablītum*.
e) The two inner ascending step-melodic intervals of the first quatrain are *šerum* and *titur išartim*.
f) When they are conjoined as a-g-f-e-d they form the step-melodic fifth *embūbum* which ends on 'd' which is the pitch of string *ḫamšu*.

2) The second quatrain, 'B',
   a) Starts with the descending step-melodic fifth *qablītum*.
   b) It is complemented with the last member of the quatrain, the descending step-melodic fifth *išartum*.
   c) The conjoining of these intervals amount to the scale *qablītum*. *qablītum* + *išartum* = *qablītum*. (f-e-d-c-b + b-a-g-f-e = f-e-d-c-b-a-g-f-e).
   d) The next quatrain starts with the descending step-melodic fifth *išartum*.
   e) The two inner melodic intervals of the second quatrain are *tītur qablītum* and *rebūtum*.
   f) When they are conjoined (d-c-b-a-g) they form the descending step-melodic fifth *pītum* which ends on 'g' which is the pitch of string *uḫrum*.

The next quatrains follow the same pattern. The last descending step-melodic fifth of the last quatrain is also the first descending step-melodic fifth of the first quatrain.

Therefore, this system consisted of a series of seven enneatonic scales.

From the above observations, we can lay the following rules:

I The first and fourth descending step-melodic fifths of a quatrain conjoin into a scale. (This scale is also - significantly - the first cited in the first quatrain of the right column of UET VII, 74).

II The last descending step-melodic fifth of a quatrain is taken as the first descending step-melodic fifth of the quatrain which follows.

III The two inner ascending step-melodic thirds amount to a step-melodic descending fifth the last pitch of which being the name of the string listed after each quatrain.

Conclusion

We do not see any purpose for this series of quatrains other than they appear to be a form of classification. However, it confirms that descending enneatonic scales are made of conjoined descending step-melodic fifths. Descending melodic fifths are made of conjoined ascending step-melodic thirds.

Endnotes

[1] Posteriorism: a posteriori, Latin for 'from the latter', is a term from logic, which usually refers to reasoning that works backward from an effect to its causes. This kind of reasoning can sometimes lead to false conclusions. See Galileo Galilei, *Treatise on demonstration*, D2.7; Atque haec est domini doctoris posterioritice qui, quum sibi iam prius fas esse scripserit, coronam regiam conspergere et conspurcare stercoribus: an non nobis fas erit posterius, huius posterioristicae linguam stercoratam, pronunciare dignissimam: ut uel meientis mulae posteriora lingat suis prioribus: donec rectius ex prioribus, didicerit posteriores concludere. propositioning. [[T]hat is, the posterioristic premise of the honored doctor. Since he has written that he already has a prior right to bespatter and besmirch the royal crown with shit, will we not have the posterior right to proclaim the beshitted tongue of this practitioner of posterioristics most fit to lick with his anterior the very posterior of a pissing she-mule until he shall have learned more correctly to infer posterior conclusions from prior premises!]. In *Responsio ad Convitia Martini Lutheri, Opera Omnia*, Louvain (1565: K3r-V3); *Opera omnia*, Frankfurt (1589: D2r-T1v). For details of the chronology and the textual history, see preface/commentary in More, ed. Headley (1969) [CW 5,2] esp. 832-845. (See eds. David A. Lines, Marc Laureys, Jill Kraye. Uwe Bauman, *The Humanistic and Religious Controversies of Thomas More* (1477/8-1535): *A Typology of Literary Forms and Genres? Forms of Conflict and Rivalries in Renaissance Europe* V&R Unipress GmbH.

[2] Some have argued that it would be legitimate to use posterioricism in the case of a lack of ancient documents to provide sufficient material for the elucidation of contemporary manuals. However, this argumentation was used to suggest that heptatonism existed at such an early period. In fact, some minimal extrapolation would have sufficed to interpret correctly these ancient documents without posterioricism, as we shall demonstrate.

[3] Sir Charles Leonard Woolley (17 April 1880 – 20 February 1960) was a British archaeologist best known for his excavations at Ur in Mesopotamia.

[4] Gurney, O.R., An Old Babylonian Treatise on the Tuning of the Harp, *IRAQ* XXX (1968), pp.229-233; Gurney, O.R., Babylonian Music, and reciprocally. Again, *IRAQ* LVL (1994), pp.101-106.

[5] The polarity of a musical system, ascending or descending is only indicating the direction of composition of a system. From a descending system, compositions may be stylistically ascending

[6] Wulstan, D., The Tuning of the Babylonian Harp, *IRAQ* XXX (1968), pp.215-228; Kilmer, Anne draffkorn, The Cult Song with Music from Ancient Ugarit: another Interpretation *RA* 68-(1974) where Kilmer quotes Wulstan who hesitates between rising or falling fifths in the interpretation of H.6 and finds the the falling version sounds better.

[7] Vitale, R, La musique suméro-accadienne, gamme et notation musicale, *UGARIT-FORSCHUGEN*, (1982), pp.241-265).

[8] Krispijn's understanding of line 12 is explained in Gurney's 1994 article cited in note 2 above.

[9] *embūbum* = [(a-g-f-e-d) = *šeru* (d-e-f)+ *titur išartu* (f-g-a)] and *pītum* = [(d-c-b-a-g) = *titur qablītum* (g-a-b) + *rebūtum* (b-c-d)]

[10] To make it simple, a Dynamic scale is a diatonic scale without any sharps or flats such as c-d-e-f-g-a-b--d, or e-f-g-a-b-c-d-e, etc.

[11] A thetical scale is a diatonic scale transposed on a specific degree which as a consequence will have sharps or flats: Dynamic c-d-e-f-g-a-b-c is thetical d-e-f#-g-a-b-c#-d, or b-c#-d#-e-f#-g#-a#-b, or f-g-a-b♭-c-d-e-f

CBS 1766: *First evidence of heptatonism*

Figure 1. CBS 1766, courtesy of the University Museum of Philadelphia, Pennsylvania, U.S.A.

This text is kept in the collections of the University Museum, Philadelphia, Pennsylvania, U.S.A. It was first published by Hilprecht over one hundred years ago in his Explorations in Bible Lands During the 19th Century[1]. The volume includes a photograph with a caption describing the manuscript as an 'Astronomical Tablet from the Temple Library[of Nippur]'.

Caroline Waerzeggers[2] and Ronny Siebes from the Vrije Universiteit in Amsterdam offered a reliable reading of most of the text, especially with regard the nomenclature on the heptagram, which they identified as the musical names for seven strings.

The tablet is divided into two sections. The first section, at the top left consists of a heptagram inscribed within two concentric circles with writing on the inner side of the circles.

The second section, below the heptagram, is a table with 11 columns the first of which is empty, with traces of script. Columns two and three are inscribed with two lists of seven numbers each (possibly eight). These columns are essential to the principal meaning of the text. A header spreads along the whole length of the columns. Some propositions have been put forward regarding its interpretation but none up to now is sufficiently intelligible.

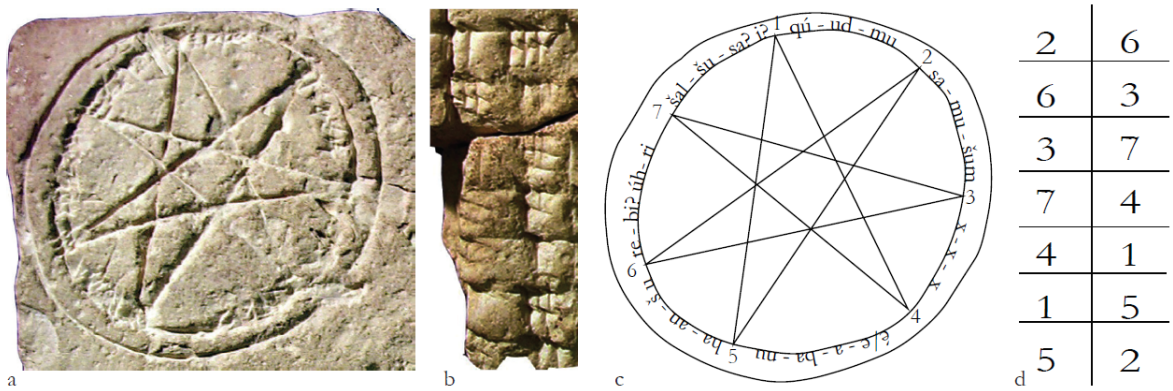


Figure 2, a, b, c and d. a) detail of the heptagram in the tablet; b) detail of the columns with the numbers related to the heptagram; c) line copy of the heptagram and transliteration; d) transcription of the numbers in the columns related to the heptagram.

The nomenclature on the heptagram and the readings of the first two columns to the left of the table are clear, as shown in figure 2, c.

The numbers in the columns express an alternation of descending fifths and ascending fourths. If '1' is 'c', then '2-6' = 'b-e'; then '6-3' = 'e-a'; '3-7'= 'a-d'; '7-4'= 'd-g'; '4-1' = 'g-c'; '1-5'= 'c-f' and '5-2'= 'f-b, (Procrustean fifth)'.

To a musicologist, this pattern suggests immediately a typical method of tuning, still in usage to this day, for the construction of a heptatonic scale by means of descending fifths and ascending fourths. We have chosen to start the pattern with descending fifth 'b-e' followed by ascending fourth 'e-a', etc. The last pitch would be a b flat excluding the octave from the heptatonic system. The heptagram associates its vertices with the names of the strings from one to seven. It is to be noted that although the number of strings has been reduced to seven out of nine, the remaining seven have kept the older nomenclature, i.e., 'front (string)'; 'next (string)'; 'third thin (string)' 'Ea-the-creator'; 'fourth-rear' and 'third-rear'. It makes no doubt that while the heptagram was a systemic revolution, it kept, nevertheless, elements of the older system. In this text, numbers 1-2-3-4-5-6-7 indicate a fixed descending scale: c-b-a-g-f-e-d in relation to the names of the seven strings; their pairing indicate the intervallic procedure to generate a tuning, in this case b-e; e-a; a-d; d-g; g-c; c-f. However, we may not exclude the possibility that the system might have been ascending in which case 1-2-3-4-5-6-7 would have equated to f-g-a-b-c-d-e, the tonal reciprocal of b-a-g-f-e-d-c. The seven numbers indicate the pitch from which to start a new scale: 1: c-b-a-g-f-e-d; 2: b-a-g-f-e-d-c; 3: a-g-f-e-d-c-b; 4: g-f-e-d-c-b-a; 5: f-e-d-c-b-a-g; 6: e-d-c-b-a-g-f and 7: d-c-b-a-g-f-e. Thus it is probable that they named each scales with a number rather than with a term as was the practice during the Old-Babylonian period.

Unfortunately, this text is incomplete. However, its readable parts are sufficiently explicit to prove heptatonism, its construction and the first evidence of cyclical pitch dispersion. The columns could be reconstructed. However, their content does not appear to give anything particular other than natural properties of the heptachord. We could assume that the header simply explained the figures in the columns, in which case, its

importance would not be of great consequence. This is possibly why the tablet was left unfinished.

More importantly is the reason why the heptagram was drawn so carelessly. While it is agreed that a heptagram cannot be drawn exactly with ordinary drawing tools, we must agree that the scribe could have done better. Then, Sara de Rose, an inspired Canadian amateur[3] offered a most interesting remark without really understanding its underlying importance. She assumed that the irregularity was intentional because it was the first ever attempt at representing semitonal values, graphically. Indeed, a regular heptagon falsely expresses heptatonism since the vertices of the star are equidistant. A closer look at the design explains her position.

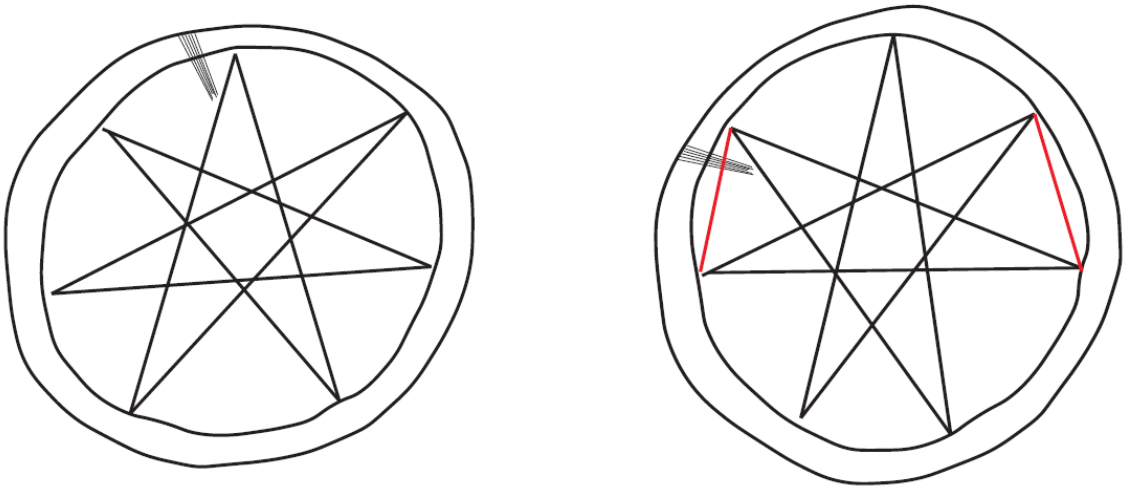


Figure 3. Left, heptagram as it is orientated in the original text. Right, heptagram rotated to locate semitones in symmetry, at both sides, delineated with red lines.

Figure 3, left, shows the heptagram in its original position in relation to the tablet. Figure 3, to the right, shows the heptagram rotated counterclockwise by about 40 degrees. Immediately the answer appears: the red lines locate the semitones in the heptatonic representation. There, they are placed symmetrically in relation to the vertical point 2, which in our hypothesis is pitch 'b' starting the sequence of alternation of descending fifth and ascending fourths, as indicated in the columns in figure 2, b and d.

The striations to the left of vertex 1 appear to emphasize the location of c.

Additionally to giving instructions for the construction of a heptatonic set, the figure was probably used as a device (build from two round plates of metal rotating, on top of one another) which located tones and semitones in each of the seven scales. For example, in the heptatonic scale of *qudmû*, the semitones are located between the first and second strings and the fifth and sixth strings.

As soon as Neo-Babylonian scholars estimated the semitone as half a tone, it would have become far easier for them, conceptually, to divide the 360 degrees of the circle into 12 sections of 30 degrees since the theory approximately divided the octave into six tones, or twelve semitones.

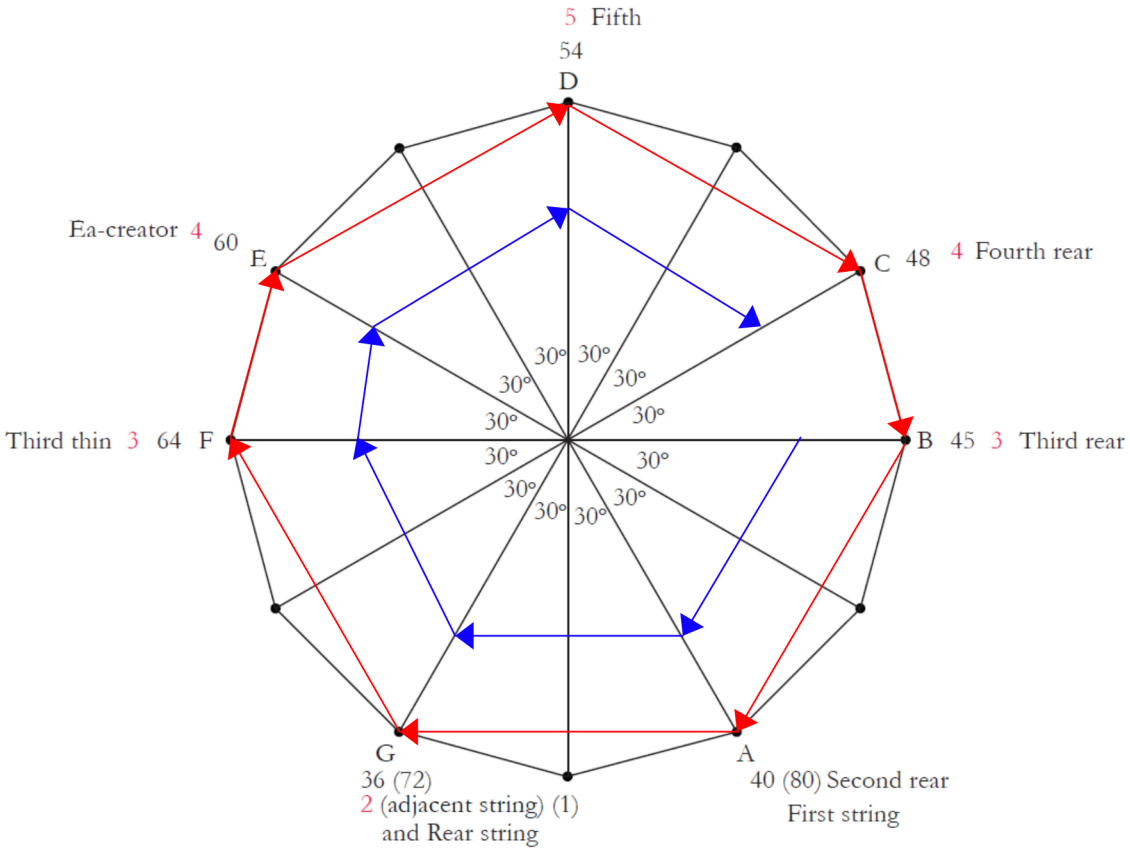


Figure 4. Dodecagram placing the enneatonic system in red numbers; Nippur quantification as adjustments to the sexagesimal division of 30 degrees per semitone and 60 per tone. Generative enneatonic scale in red; generative heptatonic scale in blue, both scales descending.

While Babylonian scholarship might have divided the circle into twelve angles of 30 degrees to quantify semitones; two semitones of 60 degrees for tones, and consequently would have invented the equal temperament system is far-fetched. It would only have existed theoretically but could not have been applied. However, they would have conceived a very convincing sexagesimal division of the musical spectrum.

Among other hypothetical inventions was their calculation of frequency. However, this was only under the form of reciprocals of strings lengths as written on four tables for the Temple library of Nippur, also excavated by Hilprecht; they might have invented chromaticism but only as a consequence of the transformation of the dynamic to the thetic, as the unexpected consequence of a system but not as a concept issuing from an epistemic cognition.

The illustration below is our reconstruction of the numbers in the columns.

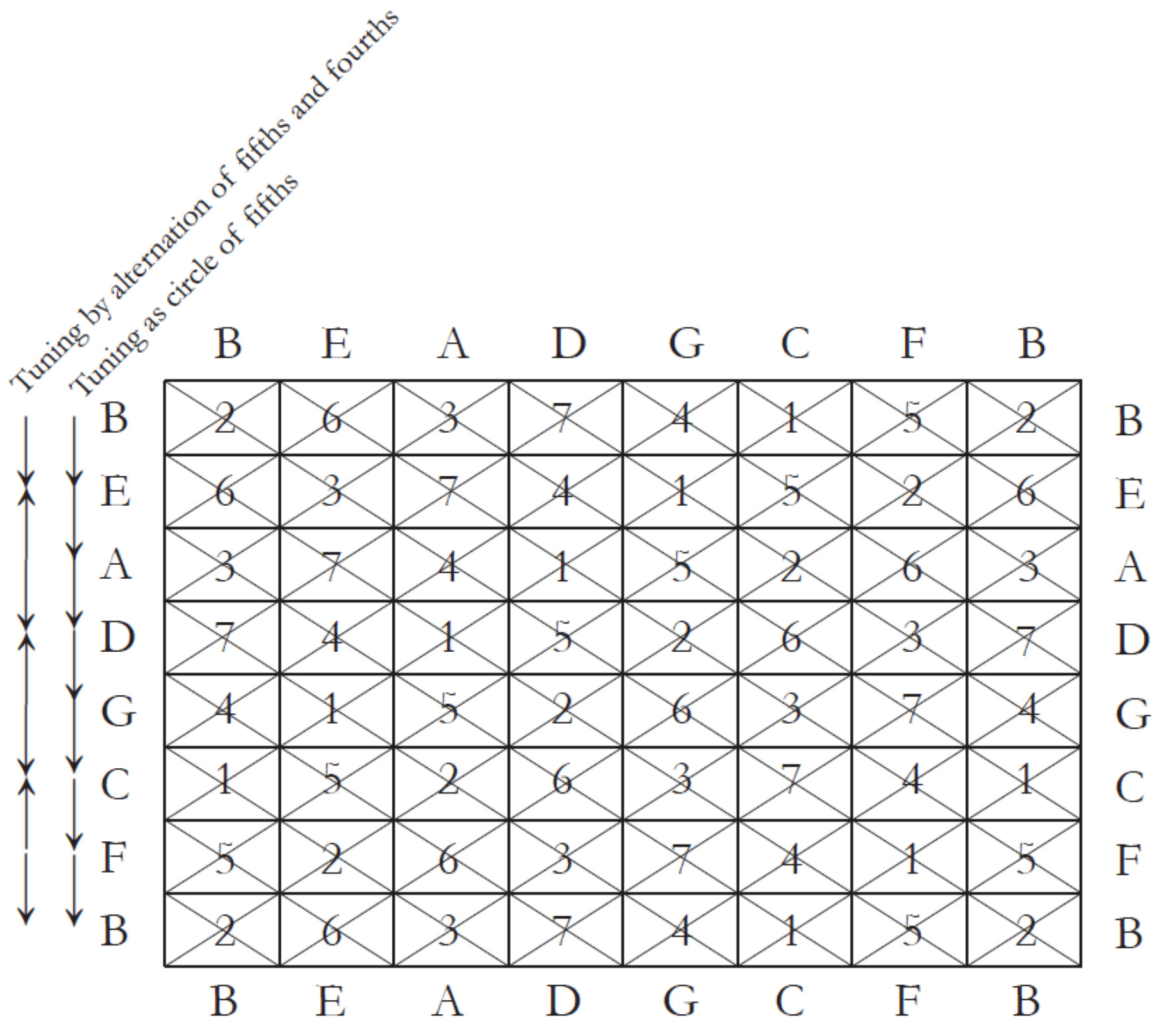


Figure 5. Reconstruction of the numbers in the tables of the texts.

Conclusion

In his theorem XVII of the *Sectio Canonis*, Euclid, who would have lived around 300 BC, would have written: 'from the *mese* 'b', tune up a fourth to 'g' and from 'g' tune down the fifth to 'd'. Thus 'b-d' is a tone. From 'd', tense the fourth to 'e' and from 'e' tune down the fifth to 'z'. 'z-d' will thus be a tone and 'z-b' a ditone.'. In other terms, from, 'e' tune up to 'a'; from 'a', tune down to 'd'; from 'd' tune up to 'g' and from 'g' tune down to 'c'. Therefore 'd-e' is a tone and 'd-e' is a ditone. CBS 1766 is half a millennium older and it is very likely that it was the source for Euclid's theorem during the Orientalising Period where Greek scholars travelled to Babylon for their education in most scientific fields, music being one of them.

Endnotes

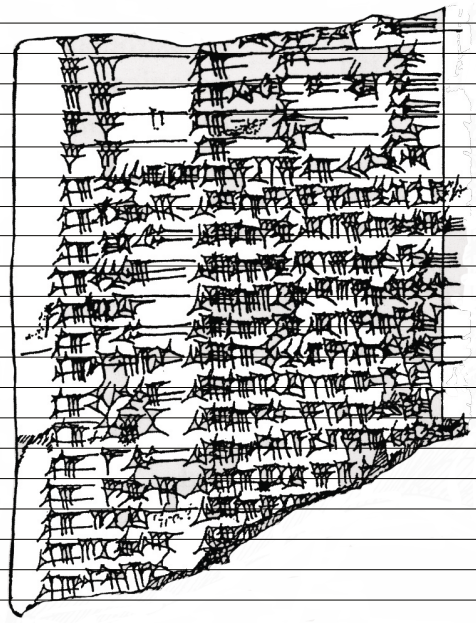
[1] Hilprecht, H.V., *Explorations in Bible Lands during the 19th century*. (Philadelphia, 1903), p. 530.

[2] Waerzeggers, C., and Siebes, R., *N.A.B.U.* (2007), no. 2 (juin), pp.43-45.

[3] de Rose, Sara., Proposing a Mathematical Basis for the Mesopotamian Tonal System. Forthcoming.

CBS 10996

Figure 1. CBS 10996, obverse. Interval numbers and nomenclature on the left column. Courtesy of the University Museum, Philadelphia, Pennsylvania.



1		1 5	sa				*nīš tuḫ-ri*
2		7 5	sa				*še-e-ru*
3		2 6	sa				*i-šar-tu$_4$*
4		1 6	sa				*šal-šá-tu$_4$*
5		3 7	sa				*em-bu-bu*
6		2 7	sa				*4-u*
7		4 1	sa				šub murub$_4$
8		1 3	sa				giš.šub.ba
9		5 2	sa				murub$_4$-*tu$_4$*
10		2 4	sa				*ti-tur* murub$_4$-*tu$_4$*
11		6 3	sa				*kit- mu*
12		3 5!	sa				*ti-tur i-šar-tu$_4$*
13		7 4	sa				*pi -tu$_4$*
14		4 6	sa				*zer - du*
15		sa *qud-mu-ú*	*ù*	sa 5-*šú*	1	5	sa *nīš tuḫ-ri*
16		sa 3! *uḫ-ri*	*ù*	sa 5-*šú*	1	5	sa *še-e-ru*
17		sa ša-ge$_6$	*ù*	sa 4 *uḫ-ri*	2	6	sa *i-šar-tu$_4$*
18		sa *qud-mu-ú*	*ù*	sa 4 *uḫ-ri*	1	6	ša *šal-šá-tu$_4$*
19		sa 3-*šú*-sig	*ù*	sa 3-*šú uḫ-ri*	3	7!	sa *em-bu-bu*
20		sa sa-ge$_6$	*ù*	sa 3-*šú uḫ-ri*	2	7!	sa 4-*tu*
21		sa ^{d}e.a.dù	*ù*	sa *qud-mu-ú*	4	1	sa šub.murub$_4$
22		sa *qud-mu-ú*	*ù*	sa 3-*šú* sig	1	3	sa giš.šub.ba
23		sa 5-*šú*	*ù*	sa šá-ge$_6$	5	2	sa murub$_4$-*tu*
24		sa sa-ge$_6$	*ù*	sa ^{d}e.a.dù	2	4	sa *ti-tur* murub$_4$-*tu*
25		sa sa 4 *uḫ-ri*	*ù*	sa 3-*šú* sig	6	3	sa *kit-mu*
26		sa sa 3-*šú* sig	*ù*	sa 5-*šú*	3	5	sa *ti-tur i-šar-tu$_4$*
27		sa sa 3-*šú uḫ-ri*	*ù*	sa ^{d}e.a.dù	7	4	sa *pi-tu$_4$*
28		sa sa ^{d}e.a.dù	*ù*	sa 4 *uḫ-ri*	4	6	sa *zir-du*

Figure 2. Hand copy of CBS 10996, obverse, left column. Hand copy after F. al-Rawi. Transliteration and reconstruction by J. Friberg.

Introduction

Neo-Babylonian text CBS 10996 dates from middle of the first millennium BC. It is well-known among Assyriologists and a few musicologists. Anne Draffkorn Kilmer was the first to publish the tablet in her 1960 seminal paper[14] which was followed by several other articles from other hands but which did not much more than copy and paste what she had already written, with, however, some philological amelioration in the Akkadian reading of a few Sumerian terms.

Nine lines have broken off at the top of the original tablet with parts of lines 24 to 28 lacking, but all could be safely reconstructed with extrapolation from lines 15 to 28. Therefore, it is divided into two sections of fourteen lines each, 1 to 14 and 15 to 28.

The first section consists in:

a) Two numbers; b) syllable '**sa**'; c) expression.

The second section:

a) '**sa**'; b) designation; c) conjunction; d) '**sa**'; e) term; f) two numbers; g) expression.

We use the term 'designation' for a string number or name, and 'expression' for the issuing interval. The two numbers in the first section equate to the two designations in the second section which are preceded by '**sa**' and are conjoined with '*ù*'. The two numbers in

the second section repeat the two numbers in the first section. The expressions which follow are identical to the expressions in the first section.

We take it that in the second section the designations preceded by the term '**sa**' equate to the numbers in the first section. They are the names of strings as we know them from text UET VII, 126. The terms ending the lines are the expressions equating to the association of the two numbers and their equivalent designations. Furthermore, the term '**sa**' in the first section indicates the expression for the association of two numbers and in the second section, the numbers indicate the names of the two designations equating to the numbers in the first section.

This does not change anything to the structure which is identical in both sections. Thus, broadly speaking, the second part is a textual expansion of the numbers in the first part and would suggest that the numbers in the first part were probably meant to replace the designations.

Both parts have identical patterns. They consist in 14 groups of paired integers limited to the number seven, the first pairs of each group will be called 'primary intervals' and the second 'secondary intervals', the reason for which will be explained later. They are arranged as follows, primary intervals in red and secondary intervals in blue.

[1-5; 7-5] [2-6; 1-6] [3-7; 2-7] [4-1;1-3] [5-2; 2-4] [6-3; 3-5] [7-4; 4-6]

They are graphically represented below in Dr. Duchesne-Guillemin's interpretation where she assumed that the system was ascending and that number 1 equated to a c; 2 to a d; 3 to an e, etc. However, Duchesne-Guillemin had also considered that the indications might have expanded to the enneatonic system in UET VII, 126[15], and also suggested that the intervals were step-melodic and not dyads as Kilmer believed.

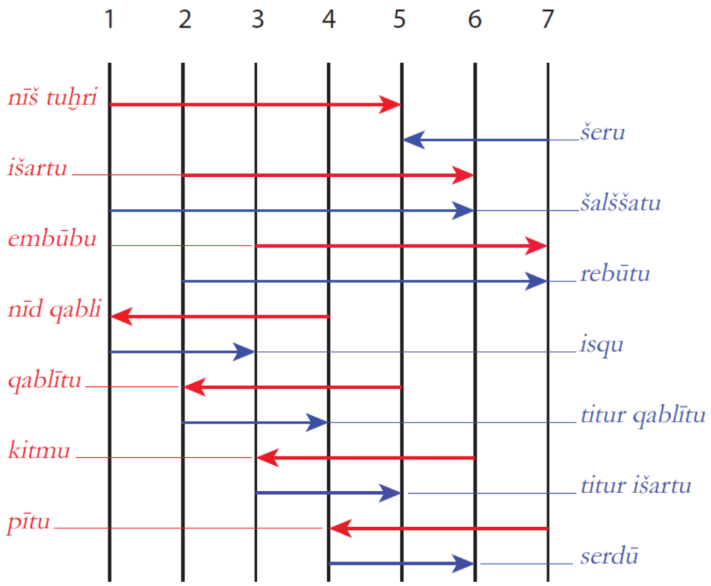


Figure 3. CBS 10996. Graphic representation of the two sections of integers and their associated terms. Primary intervals in red and secondary intervals in blue. We shall see later the significant musical meaning of these intervals. The described heptatonic ascending set of C major is Dr. Duchesne-Guillemin's hypothesis. However, she proposed that they should expand to nine pitches but Kilmer opposed this consideration.

Philological interlude

The assumption that this text was about music came from the Sumerian sign '**SA**'. For its first entry, the *Chicago Assyrian Dictionary* defines '**sa**' as: 'a string of a musical instrument', and in a second entry: 'a stringed musical instrument'. '**sa-a SA** = *ši-ir-a-nu, gi-du, pi-it-nu*'. '*Šer'ānu* (*šir'ānu*)' means sinew, as material for manufacturing objects. Sinew can be used for making short strings because it is limited to the length of tendons in animals.

1) For '*širanu*', entry 'c' has: 'for musical instruments: *išarī lu* **SA**-*an* (var. *šér-an*) *sammê* ' translates as 'let my penis be a (taut) lyre string'. Therefore, '**SA** = *ši-ir-anu*' also means 'string - of a musical instrument'.

2) For '*gīdu*', the meaning is also 'sinew - of the animal which is of economic value for making cords or the like'. Sinew might have been used for making short strings, but the term does not have any other useful definitions.

3) For '*pitnu*', there are two meanings: 1, 'string of a musical instrument'. 2, 'a stringed musical instrument'. For '*pitnu*' as a musical instrument, the *CAD* has '[**LÚ**].**NAR** *ina pi-it-ni* [. . .]' meaning 'the musician on the *pitnu* [praises you]', and '*pit-nu u rigma šumsukāku*', meaning 'I am bereft of(?) the *pitnu* and (its) sound'.

The *CAD*, sends us back to UET VII, 126. In this text there are no distinctions between '**sa**' as 'string' and '**sa**' as 'name of interval'. Babylonian scholarship may not have addressed this issue. However, would such distinction be needed? When '**sa**' is followed by two numbers such as '1 and 5', it obviously means the location and the span of an interval and when it is followed by a name, obviously, it means 'interval' (of an unknown quality). Although '**sa**' is not a determinative, it has various musical meanings. Probably unrelated, the 'SA' of Indian music is the first pitch of a scale and if Sumerian '**SA**' also means the string of musical instrument, then some analogy may be considered.

What is CBS 10996?

Since the 1960s, most have assumed that these numbers, spanning from 1 to 7, could only denote an arrangement of intervals in the ascending heptatonic framework of C major, i.e., 1=c; 2=d; 3=e; 4=f; 5=g; 6=a; 7=b. For them, ascending C major heptatonism had been once and for all imprinted in the unconscious of humankind, ubiquitously.

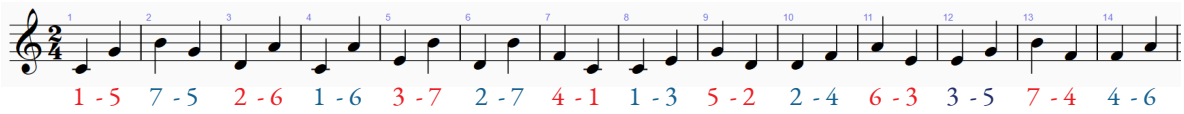


Figure 4. Duchesne-Guillemin's interpretation of melodic intervals which Kilmer rejected.

This interpretation was short-sighted as it did not even consider that the system might be descending, as most Oriental systems are. Furthermore, it was not perceived that because these intervals would have been conceptualised from an aural and linear tradition, and without evidence of a cyclical system (for which there is no evidence in this text although such as system existed at the same period as shown with CBS 1766), that in group thirteen, the F would have naturally been sharpened (f#), in relation to the previous pitch,

to avoid dissonance and remained a just fourth as are the other fourths in the system, and group 14, f#-a, a minor third. Thus, it was dogmatically established that these intervals were simultaneous and taken as dyads where both pitches are sounded simultaneously. However, there are no indications against these intervals being melodic or sounding consecutively, and being also step-melodic despite the hypothesis of simultaneousness being highly improbable even with our (limited) knowledge of music in antiquity and our better understanding of ethno-musicology. Moreover, was the playing of these intervals other than simultaneously banned during the whole story of 4000 years of music? However, this new concept was bound to bring fame in the light of this bewildering discovery, and it did, as an LP vinyl recording was produced in 1976 (re-edited in 2014 as a CD), under the title of 'Sounds from Silence[16]' with Anne Draffkorn Kilmer (Composer), Richard L. Crocker (Composer), Robert R. Brown (Composer), but what exactly did they compose?

Tuning coherence

It had been suggested that CBS 10996 described a tuning method. However, this text is coherently incomplete. For instance, with the first group of paired intervals (c-g/b-g), taking the system as ascending c major: c-g/b-g, the last 'g' is in a relation of the interval of the fourth with the first degree of the next group of paired intervals: d-a/c-a where he last 'a' is also in a relation of the interval of the fourth with the first degree of the next pair: e-b/d-b. However, with the second pair the group e-b/d-b, 'd-b' has no relations of either intervals of the fourth or the fifth with the next group of paired intervals, and the same applies for the next groups. The reason is the inversion of some of the intervals to fit in the heptatonic system and further implies that there had been a precursor of CBS 10996 with a greater ambitus of 13 degrees allowing for some coherent tuning.

It is generally accepted that intervallic coherence exists between integers, in priority for the interval of the fifth 2/3 and secondly for the interval of the fourth, 3/4 (which is the inversion of the fifth 2/3) because the 'justness' in those two intervals is most perceptible, even to the untrained ear, while with thirds such as the major, 4/5 and the minor 5/6 (and their inversion 5/8 for the minor sixth and 3/5 for the major sixth), justness is more difficult to assess.

The 'justness' of intervals is determined, when not quite justly tuned, by their emission of perceptible beats when their pitches are played simultaneously, or consecutively although of less perceptible 'justness'. These beats diminish in frequency as their tuning comes closer to 'justness' and finally disappear totally, or imperceptibly when just. Intervals of the fifth and of the fourth have been used as the most common intervals for coherent tuning systems, historically, for at least four thousand years and probably more as these are the most recognisable intervals in all societies for all kinds of learned and popular music. Intervals of thirds and their inversions as sixths also generate beats when played simultaneously or consecutively. However, they are more difficult to appreciate. For example, should one tune a major third 'c-e', then a minor third starting from the second pitch of the initial major

third 'e-g' then sound the issuing fifth 'c-g', it is most likely that it will end up as a 'false' fifth. To this description of a theoretical coherence for the tuning of intervals, the acoustic quality of the instrument is of paramount importance. With most stringed 'ethnic' instruments such as harps; lyres and lutes, beats of the intervals of fifths are barely perceptible and for a very short time due to the poor sustaining quality of instruments, slightly less for the fourth, let alone for thirds. This is probably why in most cases, with 'ethnic' music, thirds are most likely to be neither major nor minor, but mostly approximately neutral as they are placed more or less in the middle of the fifth.

About the tuning of intervals it is now appropriate to mention two types of approaches. We have mentioned the appreciation of beats per second and their fading as an interval becomes just. This method is best used when ratios of intervals have the simplest integers such as 1/2; 2/3 and 3/4. Beyond these, with 'primitive' instruments, beats become more difficult to appreciate. This is a method which can be used when a stringed instrument, particularly, has sufficient sustain allowing for the counting of beats per second. On the other hand, when an instrument has a good sustain, such as the piano, then the beats of intervals of the third are used because their frequency can be precisely counted for the more complex tuning in the equal temperament (for instance f-a in the middle of the keyboard should sound 7 beats per second. However, instruments of the string quartet rely on their tuning in just fifths while on the piano, fifths are slightly smaller than just and therefore, fourths, slightly larger than just as a consequence of one being the reciprocal of the other. 'Ethnic' and other 'primitive' instruments cannot rely on the counting of beats of thirds and therefore rely mainly on fifths and fourths. However, there is another method which comes from a 'subjective tonal memory' and uses chains of thirds, for instance, in a descending motion. For the purpose of demonstration I will use numbers rather than pitches in order not to suggest any specific pitch set: 9-8-7/8-7-6/7-6-5/6-5-4/5-4-3/4-3-2/3-2-1. This method will generally generate neutral thirds around 350 cents, (against 300 cents for the minor third and 400 cents for the major in the equal temperament) two neutral thirds amounting to a just fifth. Then it would be for the musician to correct thirds to make them major or minor depending on purpose. Therefore, the likelihood that CBS 10996 in its status, described a tuning system is highly improbable although it could have been in its antecedent tridecachordal ambitus.

Linearity versus cyclicity

It had been advanced that the series of paired numbers in this text was evidence of a cyclical system of tuning (where, for instance, the last integer of the sequence would lead, logically and systemically, back to the first integer of that sequence to start the sequence all over again). However, this is not the case as the most common sequence of integers for a coherent tuning requires a cyclical alternation of fifths and fourths within an inscribed heptagram with chords of arcs drawn between the vertices of the polygon as with text CBS 1766 where the last integer of the sequence lands onto the first integer whence it started. However, this poses two problems. Taking the paired numbers in column 2 of CBS 1766:

2-6; 6-3; 3-7; 7-4; 4-1; 1-5 and 5-2, as descending series where number 2 is 'b' and assuming an alternation of descending fifths and ascending fourths, the first 2 is a 'b' and the last would naturally be a 'b𝄫' because of the nature of the alternation of such intervals. Thus the last pitch is not the repetition of the first one. This would only be problematic within a theory based on, or including the octave. However, there is no such evidence and so, the series would have continued as e𝄬; a𝄬;d𝄬; g𝄬; c𝄬; f𝄬 and b𝄫𝄬 . However, it is very unlikely that melodies in the first millennium BC would have expanded beyond the seventh pitch. The scale would have been truly ditonic diatonic and heptatonic, without the exosystemic octave. However, another alternative where the scale consisted if six intervals of 185 cents and one of 90 cents. I this case, the first and last pitches would have been at one octave from each other. However, this would exclude a tuning by means of simultaneous alternating descending fifths and ascending fourths as these intervals would sound very rough, but if tuned consecutively, the same intervals would become 'acceptable' to an ear not accustomed to our modern perfect fourths and fifths. Interestingly, the beats for the thirds, in this experimental tuning, are pleasing to the ear. However, this hypothesis must remain experimental as there is not a shred of evidence that it would have been used in Ancient Mesopotamia or elsewhere, but who knows as the appreciation of the value of the tone varied considerably in various 'ethnic' settings.

Since the description of strings and the intervals they have between them in CBS 10996 have only little coherence for their consideration as a cyclical phenomenon, we shall take it that their concept was linear and probably came from a cognition process which came from the yoke of the lyre on which the strings are affixed as clearly laid out with text UET VII, 126. With CBS 10996, there are seven string on the 'cognitive' yoke and their relationship is described with the illustration below:

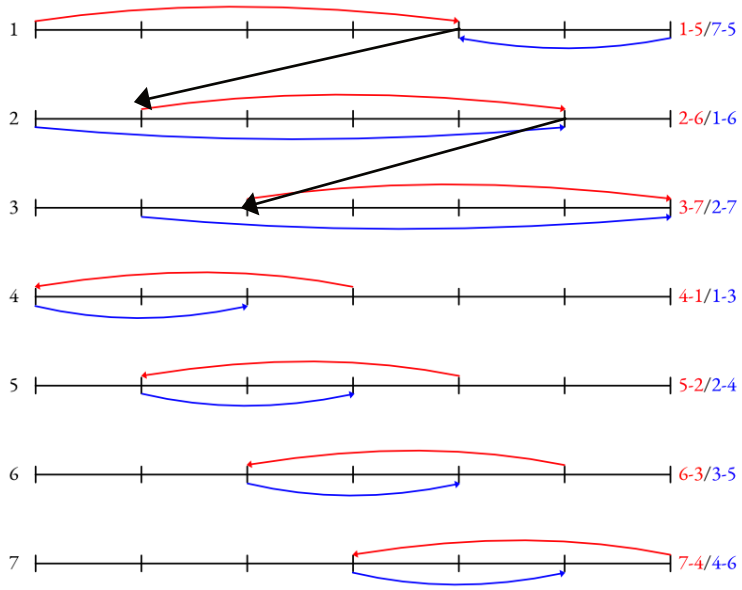


Figure 5. Linearity of CBS 10996. Note that the seven groups are independent from one another, as they have no logical relationship between them. The two black arrows show the only two coherent tuning relationships by fourths.

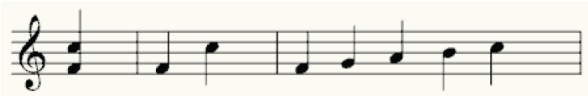
Polarity

Numbers in this text have ascending (1-5; 2-6, etc.) and descending (7-5; 4-1, etc.) orientations or polarities. Polarity in a system is not the simple matter of reading a series of pitches from the bottom or from the top, i.e., c-d-e-f-g-a-b and b-a-g-f-e-d-c but depends on symmetrical relationships, i.e., ascending f-g-a-b-c-d-e and descending b-a-g-f-e-d-c, the former being the reciprocal of the latter.

With CBS 10996, intervals have irregular polarities. In the order in which they are listed, from 1 to 5, it is ascending, from 7 to 5, it is descending; from 2-6, it is ascending and from 1 to 6, it is also ascending. From 3-7, ascending; 2-7, ascending. 4-1, descending; 1-3, ascending, etc. There is no coherence in such a confusion of irregular polarities.

Consecutive or simultaneous nature of intervals

Intervals may be of three types:



harmonic melodic step-melodic

They can be a) harmonic or simultaneous; b) melodic or consecutive, or c) step-melodic. Kilmer decided without any evidence that the intervals in CBS 10996 were simultaneous, or 'dyads' as she calls them, while Duchesne-Guillemin, Wulstan and ourselves saw them step-wise melodic.

While there is no conclusive evidence that the Akkadian conjunction '*ù*' placed between two integers of an interval meant, in the case of music, that these pitches were to be played simultaneously or consecutively, the hypothesis that they were exclusively simultaneous dyads is spurious. Firstly, we are not aware of any ruling in any culture, for these not to be played consecutively, as we have mentioned before. Secondly, the polarities of these intervals would surely indicate the order in which the pitches were played. When we have 1-5, it seems obvious that the first pitch to be played would have been 1, and with 7-5, surely the seventh pitch would have been played first. If these intervals were meant to be played simultaneously there would be no reason for changing their polarity since 1-5 or 5-1 would have sounded the same.

Thirdly, when Kilmer was confronted with the Hurrian text H.6 which is a song dating from around 1400 BC where the musical notation is written by means of intervals, then, had intervals been dyadic, then how would the voice have sung two pitches at the same time? Kilmer's answer to these 'horns of dilemma' was that the song was accompanied by a lyre (although the colophon of the tablet does not mention any accompaniment[17]) and because the lyre can play two pitches simultaneously, then the problem was solved: the singer could chose which of the two pitches to sing. What an awkward system and what an insult to the creativity of Ancient Near-Eastern musicians!

And thus, Kilmer and others should have changed their views to agree with the evidence. However, they changed the evidence to match their views.

There is another strong argument in favour of the intervals in CBS 10996 being step-melodic. The reason is that besides numbers which locate them on a given scale, these numbers do not specify the nature of the pitches within that interval. Therefore, names would have defined the melodic content of intervals as melodic/syllabic incipits. For instance for the interval 1-5, the term which is associated with it, *niš tuḫrim*, would be a syllabic melodic incipit giving the five pitches c-d-e-f-g as the melody of that incipit and made up of a semitone, tone, tone and tone (1-1-1/2-1). This is the method used in the Oriental *maqam* where names of specific intervals known as *ajnas* (intervals) remind the musician of melodic content withou knowledge of theory.

The purpose of CBS 10996

We have conclusively established that while this text is descriptive in that it locates and names, within a heptatonic grid, and in a manner which is certainly not convincing, the following series of intervals:

5 thirds:	7-5; 1-3; 2-4; 3-5; 4-6
4 fourths:	4-1; 5-2; 6-3; 7-4
3 fifths:	1-5; 2-6; 3-7
2 sixths:	1-6; 2-7

while a logical series of intervals within a heptachord would be as follows:

5 thirds:	1-3; 2-4; 3-5; 4-6; 5-7
4 fourths:	1-4; 2-5; 3-6; 4-7
3 fifths:	1-5; 2-6; 3-7
2 sixths:	1-6; 2-7

The intervals in both arrangements have the same harmonic value since the inversion of a given interval retains the same pitches (c ↗ g/ c ↘ g). What differs is their content. 1-5 has five pitches (c-d-e-f-g) while 8-5 has four (c-b-a-g).

1-5/7-5	2-6/1-6	3-7/2-7	4-1/1-3	5-2/2-4	6-3/3-5	7-4/4-6
1-5/7-5	2-6/8-6	3-7/9-7	4-8/10-8	5-9/11-9	6-10/12-10	7-11/13-11

The top row gives the heptachordal number sequence of CBS 10996; the lower row, its arrangement in what would be an antecedent tridecachordal hypersystem.

The graphic examples overleaf will demonstrate that CBS 10996 was not an original treatise but only the heptatonic adaptation of a precursory text that we shall name proto CBS 10996, a tridecachordal hypersystem.

This is best illustrated with the two following graphs:

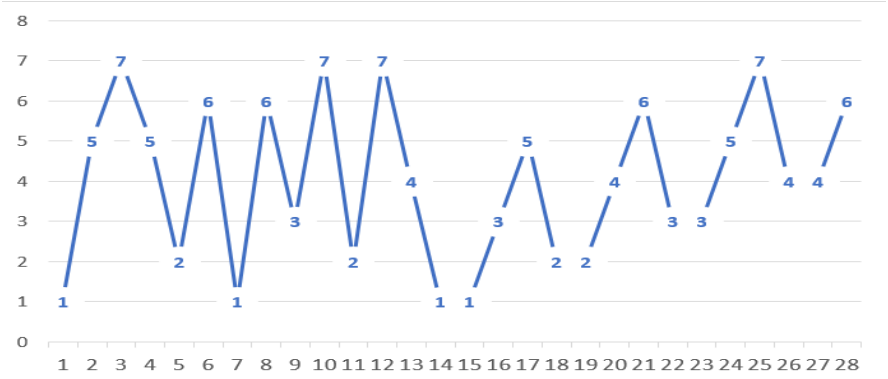


Figure 6. Graphic transposition of the intervals in CBS 10996, ascending.

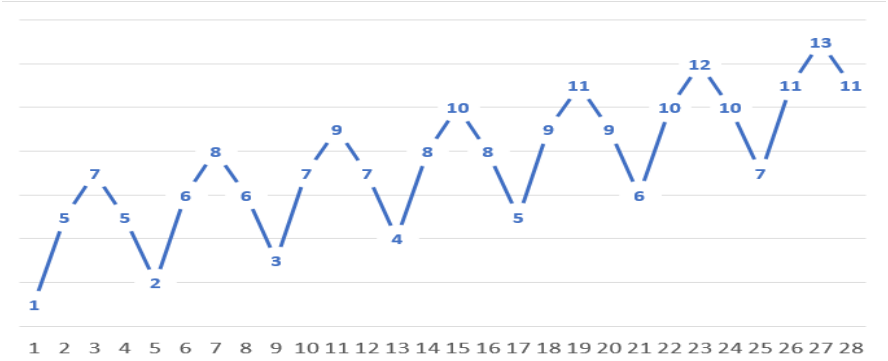


Figure 7. Graphic transposition of the intervals in CBS 10996 without change of polarity, ascending.

The illustration in figure 7 shows the regularity of a system compared to the irregularity in figure 6.

Descending versus ascending

Up to now we have assumed that CBS 10996 described an ascending heptatonic system, according to Kilmer and others. However, Old-Babylonian text UET VII, 74, about 1800 BC, has conclusively proven that the system was descending, thanks to the sagacity of friend and scholar Th. Krispijn, or at least, that this unique document is at present the only one to attest of a descending system among the few texts of theory. However, the presence of one text only, proof of a descending system, is not proof that ubiquitously and intemporally all Mesopotamian music was descending, no more than it was ascending in the light of a few texts which would have been construed as describing an ascending system.

Thus, we have to consider both rising and falling hypotheses and we shall bring back our postulation of some decades ago whereby we were in favour of a symmetrical system, precisely because of the problems regarding the orientation of CBS 10996, the structure of UET VII, 126, that we have discussed earlier, and our observation of symmetry in the Sumerian-Babylonian mythological iconography. To this, we shall add our postulation that the seminal structure of melodies in pre-literate music relied on the third, as a cognitive cell,

where the tonal axis would be the central pitch from which chains of consecutive thirds grew into hypersystems. Among those structures which developed organically, were pentadecatonism, tridecatonism, hendecatonism, pentatonism, enneatonism and finally, the exosystemic heptatonism, since it relies on fourths rather than on fifths, in the first millennium BC.

This conclusion came in spite of our initial opinion that CBS 10996 was a descending system, but that there were some obstacles with which we were struggling. This was resolved with our symmetrical hypothesis showed below:

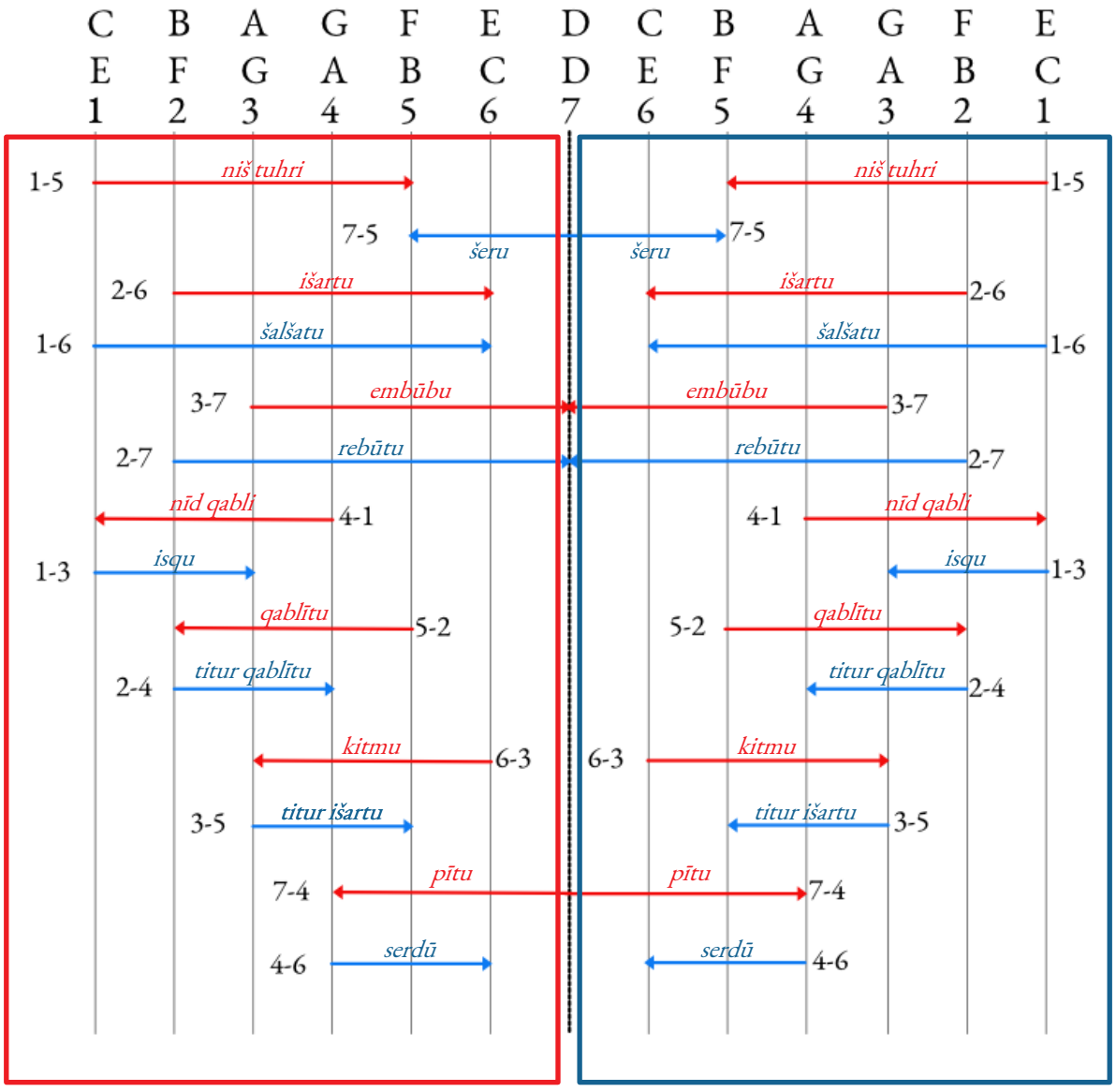


Figure 8. In the red frame, ascending heptatonic hypothesis; in the blue frame, the descending heptatonic hypothesis of text CBS 10996. Both gravitate around the axis of tonal symmetry, pitch 'D'. Note that the terms are written without mimation or the adding of a final 'm'. The reason is, roughly speaking, that this mimation was characteristic of Old-Babylonian but was dropped in the first millennium.

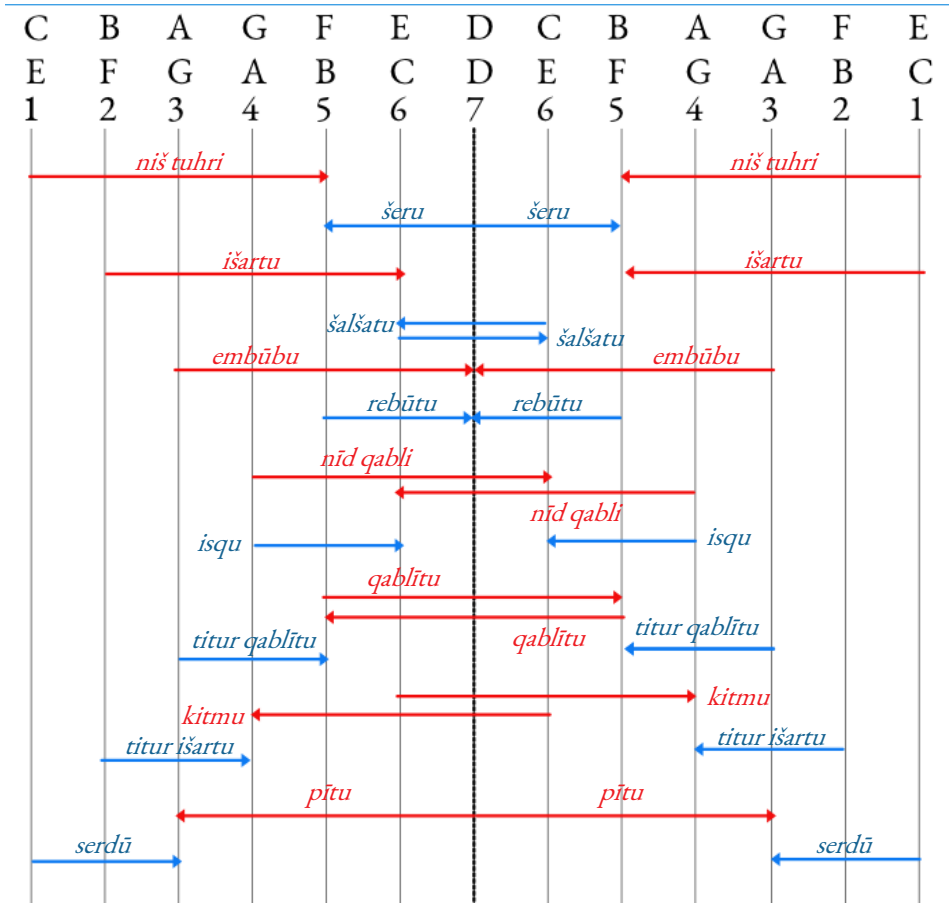


Figure 9. Symmetry in the reconstructed hypothetical tridecatonic forerunner of CBS 10996.

Figures 8 shows the position of intervals as they stand with CBS 10996, in both their heptatonic ascending and descending status showing symmetry around the central tonal axis 'D'. Figure 9 gives the position of intervals as they would have been placed in their original hypersystemic tridecatonic status, or proto CBS 10996, in a symmetrical order around central tonal axis 'D'.

Thus we may agree that originally the span organisation included seven rising or falling fifths and of seven rising and seven falling thirds while the heptachordal arrangements gave a series of intervals which were the adaptation of the former arrangement as given in CBS 10996.

Conclusions

This text is the adaptation of a catalogue of seven intervals of fifths and seven intervals of thirds, rising or falling, and which would have been either harmonic, melodic, and/or (step)melodic depending on purpose. The initial intervals of fifths and thirds were initially

a set of a tridecatonic span/system, probably during the third and second millennium BC and then, during the middle of the first millennium BC, with the advent of heptatonism, these intervals were made to fit a heptatonic grid by means of inversion of intervals, which in the initial hypersystem exceeded the range of the heptachord. While this innovation had less importance for harmonic intervals, as c-g and g-c, for example, sound the same harmonically, but it certainly was critical when these intervals were step-melodic because an inverted fifth with five pitches became a fourth with only four pitches; an inverted third of three pitches became a sixth with six pitches. Thus, it can further be postulated that other versions of CBS 10996 would have been written, in addition to the tridecatonic and the heptatonic, for the enneatonic and hendecatonic hypersystems when appropriate intervals were needed. It is therefore critical that a music text such as the Hurrian song H.6, written about 1400 BC, may not be reconstructed with an interval catalogue of the middle of the first millennium BC. It must further be stressed that these intervals, may they be extracted from the tridecatonic, the hendecatonic, the enneatonic or the heptatonic, may be played either simultaneously, melodically or step-melodically depending of their function in the theory or in the practice for which they would have been intended. For example, the tuning of a fifth could be tested either harmonically or melodically, or both, while their step-melodic status would be specifically used in composition. It is exactly the same we do today and I do not see any rationality for Kilmer and her supporters having decided that these intervals were harmonic, exclusively.

Endnotes

[14] Kilmer, Anne Draffkorn. Two new lists of key numbers for mathematical operations, *Orientalia* 29 (1960), pp. 273-307.

[15] Duchesne-Guillemin, M., Découverte d'une gamme babylonienne*, Revue de musicologie,* Vol. 49, juillet (1963), p. 9. and Kilmer, The strings..., *AS.* 16, (1965)

[16] *'SOUNDS FROM SILENCE'. Recent discoveries in Ancient Near Eastern Music. Side 1: Demonstration of Old Babylonian Tuning Procedure for a Lyre. Side 2: A Hurrian Cult Song from Ancient Ugarit.* BIT ENKI RECORDS, PO Box 9068, Berkeley, California 94709, U.S.A.

[17] The colophon of tablet H6 is unequivocal: It reads:[*an-nu*]-*ú za-am-ma-rum ša ni-id-kib-li za-l*[*u*]-*z*[*i ša* DINGIR.MEŠ TA m*Urḫiya*] *šu ammu-ra-bi*, which translates as: 'This is a song in the scale of *nidqibli* a *zaluzi* for the gods, written by *Urḫiya* and composed by *Ammurabi*'. It is a song, unequivocally. There are no indications of any instrumental accompaniment. The CAD says: 'to sing a song with or without instrumental accompaniment' However, when the song is accompanied, the instrument(s) are given, example: one of the *kalû*-singers stands up *ina ḫalḫallatim* ER.S[E.M]A.ŠE *ana Enlil i-za-mu-ur* and sings an ersemma-song to Enlil to the accompaniment of the *ḫalḫallatu*-drum RA 35 3 iii 14 (Mari rituals).

YBC *11381*

More evidence for Neo-Babylonian Enneatonism in Music Theory?

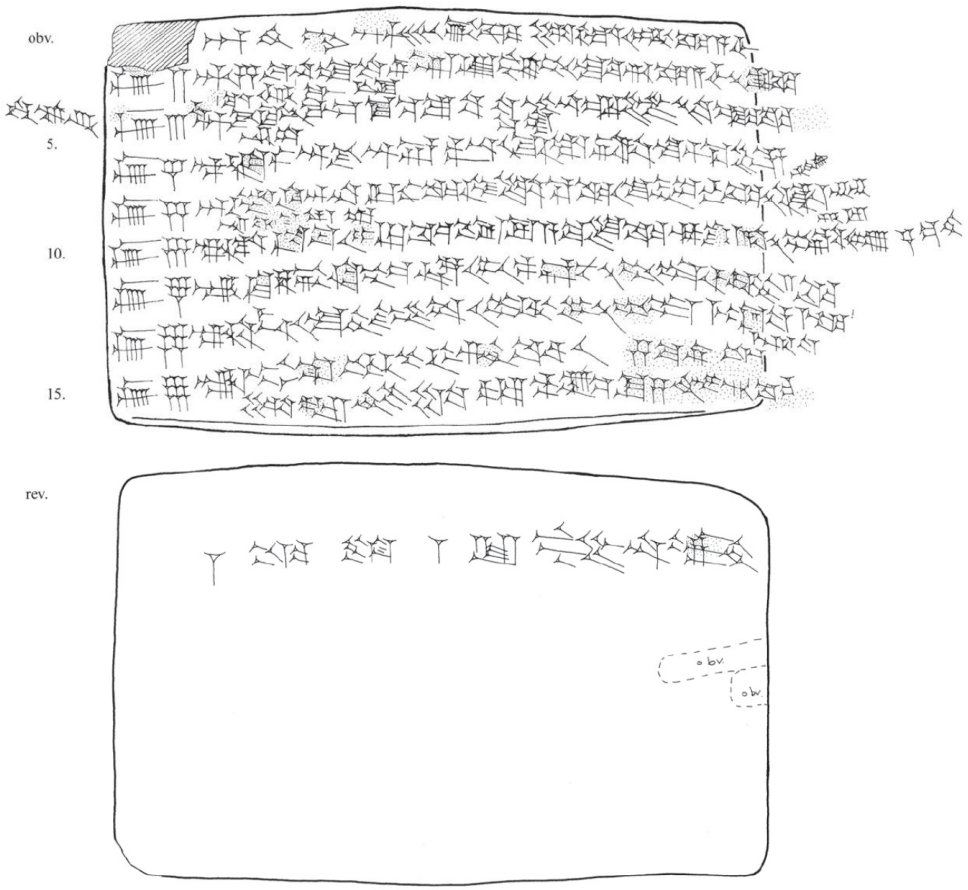


Figure 1. Payne's Hand copy of YBC 11381, obv. and rev. (5.8 x 8.9 x 2.5 cm).

Obv. [sa] ⌜1⌝ an.šár ⌜lugal dingir⌝ meš *be-lut-ka li-dam-mi-iq ka-a-ši*
⌜sa⌝ 2 d 15 *ba-na-at te-* ⌜*né-šit*⌝ *ṭu-ub lib-bi u la-ba-ri ka-as-ši liš-* ⌜*ruk*⌝ *-ka*
Sig *da-ar!-gal kak-ku*
sa 3 dàra.gal giš tukul *ez-zu-tú u₄-mu na-al-bu-bu liš-tam-ḫir-ka* [(x)]
5 en du *qa-at*
sa 4 den! ⌜ki⌝ . dù dgašan dlamma *pa-ti-qat dam-qá-a-tú la-mas-si bu-un-(ni)*
gi-ir
sa 5 d ⌜dam.ki⌝ .an.na *tés-lit-ka ṣu-le-e-ka u la-ban ap-pi-ka liš-tam-gir ana* en.en
en- ⌜da-šu⌝ *-ru-um* *ri-ib*
10 sa 6 den.da. ⌜šurim.ma *mi*⌝ *-lik-ka nak-lu a-ma-tu-ka aq-* ⌜*ra*⌝ *-a-tú liš-taq-rib*
u₄-mi-šam šá-am
sa 7 den.du₆.kù.ga ⌜*ki*⌝ *-bi-is šul-mi u pa-* ⌜*dan*⌝ *-nu liš-tak-kan ana ši-* ⌜*kin*⌝ gir II *-ka* ME
sa 8 den.u₄.ti.la *ḫi-ṣib ṭuḫ-du u* ḫé.gál-*lu₄ liš-tak-kan ana me-* ⌜*rit*⌝ érin me *-ka !*
me-ri-tú
15 sa 9 den.me.šàr. ⌜ra⌝ *il-lat rag-* ⌜*gí*⌝ *-ka u* ⌜*za-ma-ni-ka*⌝
li-šab-bir li-sap-pi-iḫ giš ⌜tukul *za-'-i-ri*⌝ *-ka*

---

rev. *ana* ka sar *ana ṭu-ub-bi na-* ⌜*as*⌝ *-ḫi*
le.e. *šal-šú uḫ-ri*

Obv. STRING 1: May Aššur, the king of the gods, improve your dominion for you.
STRING 2: May Ištar, who created mankind, grant you well-being and longevity.
(gloss)
STRING 3: May Daragal make you rival the fierce weapon (s and) the raging storm.
5 (gloss)
STRING 4: Enkidu, treat kindly the Lady, the protective spirit who created good things, the *lamassu*.
(gloss)
STRING 5: May Damkianna make your appeal, your prayers, and the stroke of your nose always pleasing to the lord of lords.
(gloss)
10 STRING 6: May Endašurimma present your artful advice and you precious words daily.
STRING 7: May Endukuga always let your footstep fall on a prosperous road ans a smooth path. (gloss)
STRING 8: May Enudtila constantly establish abundance, plenty, and prosperity for the pastures of your people.
(gloss)
15 STRING 9: May Enmešarra crush the forces of those who wrong you and of your enemies. May he scatter the weapons of your adversaries.

Rev. Copied according to dictation; excerpted for (my) well-being. (left edge) The third (string) from the end.

Figure 2. Payne's transliteration and translation.

This text was first published by Elizabeth Payne of Yale University[1]. It lists nine strings. Each string number is followed by an incipit. The nine strings are obviously those known from UET VII, 126 and suggested in UET VII, 74. Unlike their disposition in texts the two aforementioned texts where the nine strings of the giš**ZÀ.MÍ**-instrument are listed, in UET VII, 126, or suggested, in UET VII, 74, palindromically as 1-2-3-4-5-4-3-2-1, from Old- Babylonian to Neo-Assyrian, a period of about 1500 years, YBC 11381, which is Neo-Babylonian, has the strings listed sequentially as 1-2-3-4-5-6-7-8-9.

The argument in this paper is that the nine '**sa**' in YBC 11381 are no longer used only for listing strings *per se* but would also be used for naming nine enneatonic scales generated from the system described in UET VII, 74 as shown below:

sa 1 May Aššur, the king of the gods, improve your dominion for you.
(c-b-a-g-f-e-d-c-b)?
sa 2 May Ištar, who created mankind, grant you well-being and longevity.
(c-b-a-g-f#-e-d-c-b)?
sa 3 May Daragal make you rival the fierce weapons and the raging storm.
(c#-b-a-g-f#-e-d-c#-b)?
sa 4 Enkidu, treat kindly the Lady, the protective spirit who created good things, the *lamassu*
(c#-b-a-g#-f#-e-d-c#-b)?
sa 5 May Damkianna make your appeal, your prayers, and the stroke of your nose (a gesture of respect) always pleasing to the Lord of the Lords.
(c#-b-a-g#-f#-e-d#-c#-b)?
sa 6 May Endašurimma present you artful advice and your precious words daily.
(c#-b-a#-g#-f#-e-d#-c#-b)?
sa 7 May Endukuga always let your footstep fall on a prosperous road and a smooth path.
(c#-b-a#-g#-f#-e#-d#-c#-b)?
sa 8 May Enudtila constantly establish abundance, plenty, and prosperity for the pastures of your people.
(c#-b#-a#-g#-f#-e#-c#-d#-b#)?
sa 9 May Enmesarra crush the forces of those who wrong you and of your enemies, May he scatter the weapons of your adversaries
(c#-b#-a#-g#-g-e#-c#-d#-b#)?

The enneatonic scales given here for each incipit are only illustrative for the reason that firstly, there is no evidence that the scales in this text were descending. Secondly, the names of strings as sa1; sa2; sa3, etc., might only be strings dedicated to specific incipits. However, it would be more reasonable to assume that each of the incipits were sung to a particular scale, as in Western music where specific pieces are played in C major or B minor. Thus, this text would suggest that contrarily to our understanding that there were only seven scales in the system, we could construe that there were nine. However, it is not possible to establish a rule from one and only text. Thus **sa1** would have been dedicated to Aššur; **sa2** to Ištar; **sa3** to Daragal; **sa4** to Enkidu, which is appropriate as the fourth string is also called ^{d}*Ea-bānû* (DÙ)", (given that Ea and Enki are equivalent), in U.3011; **sa5** to Damkianna; **sa6** to Endašurimma; **sa7** to Endukuga; **sa8** to Enudtila and **sa9** to Enmesarra.

There is only one conclusion that may be drawn from this text: enneatonism was still practised during the first millennium BC.

Endnotes

[1] Payne, Elizabeth E., A new addition to the musical corpus, *Opening the Tablet Box in Near Eastern Studies in Honor of Benjamin R. Foster*, Sarah C. Melville and Alice L. Slotsky eds. Brill, (Leiden-Boston 2010), pp. 291-300.

PITCH QUANTIFICATION

Firstly, pitch quantification, or the ascription of frequencies to pitches from the manner in which they are encrypted in ancient documents, is mostly considered worthless by most musicologists, for some apodeictic-sounding reasons. Secondly, we would argue that for many other causes, perseverance may be rewarding in rare occurrences making the exercise worthwhile. '*...ne laissez nulle place où la main ne passe et repasse*[1].' Thirdly, cultural preferences for intervals sounding offensive to our Western ears and which might be pleasant in another context should never be considered on the basis of our own preferences.

We are accustomed to the nature of pitch sequences from the environment where we evolved, in the same manner as some may get used to their out of tune piano and then find its recent tuning strange if not unpleasant. However, while the distance between one pitch and the other, in another cultural sphere, might be different from our own expectations from the same interval, there are certain fundamental intervals which remain identically appreciated in the many different traditions where they happen. Far from waiving the universalist banner, nevertheless, I contend that there are similarities shared by the human species, ubiquitously. Our ears have evolved to appreciate the sounds of our environment and it is axiomatic that they would have grown fond of sounds, or most of them, emanating from our vocal folds, and later, from instruments, among all other sounds of nature. Thus there are referential intervals of which the fifth is essential and there are mobile pitches within the boundaries of the fifth the order of which defining mood, which in turn became Sanskrit *jánas*, Akkadian *ginû*, Greek *genos*, Latin *gĕnŭs*, Arabic *jins* and eventually 'mode' the meaning of which having been distorted in the course of centuries.

The interval of the fifth is the most common and preferred interval shared by our human species. The stimulus caused by that interval would be the fastest to reach our cerebral cortex, which would seem a reasonable assertion. It is the consequence of the nicest ratio of string lengths according to Pythagoras, if he ever existed. He would have said that after the octave, the fifth was the most pleasing interval. These are large intervals and it is unlikely that they were used in antiquity within melodies. If they were, they would have been the tonal place where women and children sang the same melody, but an octave

higher, because of the anatomy of their smaller vocal folds. However, these octaves are not conceptual because they were not sung by design, but as anatomical consequences.

Octaves, fifths and fourths are tone and mood[2] containers. The octave hosts a fifth 3:2 and a fourth 4:3. 3:2+4:3 = 12:6 = 2:1 (702+498 = 1200). A fourth is an inverted fifth (c-g/g-c'). They are complementary within the octave. However, although the boundaries of fourths and fifths are of the same pitch class, and thus sound the same, harmonically, they are distinct, melodically, the fourth hosting two and the fifth three pitches. Therefore, the step-melodic interval of the fifth is the interval of predilection for both tone and mood expressions. In the music of antiquity, all happens within the fifth. It is their conjoining which conceptualised enneatonism consisting in an ideal transformational generative method, where the replacement of its constituting fifths create a multitude of possible tone and mood combinations that the heptatonic system of conjoined fourths could not achieve, until later, during the twelfth century AD when it became harmonic.

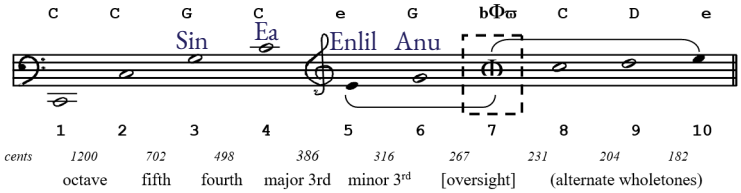


Figure 1. Ernest McClain's harmonic series as naturals defining reference for pitch ratios. God names added by the author.

The god-number hypothesis

The sexagesimal counting system[3] was known by Sumerians, over five thousand years ago, but it was not until the beginning of the second millennium B.C. that Babylonians gave their major gods hierarchical numbers[4]. Anu was represented with number 60, Enlil with 50, Ea with 40, and Sin, the moon god, with 30. The ratio of Anu to Enlil (60:50) is the minor third (316 cents); the ratio of Enlil to Ea (50:40) is the major third (386 cents); the ratio of Anu to Ea (60:40) is the fifth (702 cents); the ratio of Ea to Sin (40:30) is a fourth (498 cents) the ratio of Enlil to Sin (50:30) is the major sixth (884 cents).

Although other gods have their own numbers, these four gods, Anu, Enlil, Ea and Sin suffice to generate both major and a minor scales by the process of their combinations. This quantification produces a fifth (3:2) of 702 cents, a fourth (4:3) of 498, a tone (10:9) of 182 cents, a semitone (16:15) of 112 cents. These figures give the following intervals:112; 182; 204; 204; 112; 204. They could be arranged in descending c-b-a-g-f-e-d, the first scale of the heptatonic system *išartum*.

However, there is no evidence that these numbers were at all used for musical purposes and similar coincidences are found with the decimal system with, for instance, 100; 90; 80; 70; 60, 50, 40, 30 and 20 which would also generate musical intervals: 100:90 = 182 cents, the minor tone; 90:80 = 204, the major tone; 80:70 = 231, the supersecond; 70:60 = 267, the septimal third; 60:50 = 316, the minor third; 50:40 = 386, the major third; 40:30 = 498, the fourth and 30/20 = 702, the fifth. It remains that the first four Babylonian god numbers, 60; 50; 40 and 30 encapsulate a far more rational template from which to base a mythological/musical system.

Pitch quantification in text CBS 1766

Text CBS 1766 gives indications for the construction of a set of seven descending scales by means of a method consisting in descending fifths and ascending fourths (or inversely), from number 2, descending, in the inscribed heptagram described page 62: b-a-g-f-e-d-c; from number 3, the scale is a-g-f-e-d-c-b; from number 4: g-f-e-d-c-b-a; from number 5: f-e-d-c-b-a-g; from number 6: e-d-c-b-a-g-f; and from 7: d-c-b-a-g-f-e; and from 1: c-b-a-g-f-e-d.

The consequence of this alternation of fifths and fourths is that it naturally generates the same intervals as those issuing from the four principal god numbers because in both cases, all intervals have the same value where the semitone measures 90 cents, the tone 204 cents, the minor tone 316 cents, the major tone 386 cents, the fourth 498 cents, the fifth 702 cents, the minor sixth 814 cents, the major sixth 884 cents and the seventh, 1088 cents.

Thus we may conclude that a Babylonian scale, from the second millennium onward was identical to the scale used in the West until the adoption of various temperaments, concluding with the equal temperament where the differences between both are minimal:

Interval	Babylonian	Western Equal Temperament
semitone	90	100
tone	204	200
minor third	316	300
major third	386	400
fourth	498	500
fifth	702	700
minor sixth	814	800
major sixth	884	900
seventh	1088	1100

This would generate the heptatonic scale: c-b-a-g-f-e-d-(c) with quantification:
0; 90; 294; 498; 702; 792; 996;(1200)
The first seven scales in CBS 1766 would have been:

a)	b-a-g-f-e-d-c-(b):	0; 204; 408; 612; 702; 906;1110;(1200)
b)	a-g-f-e-d-c-b-(a):	0; 204; 408; 498; 702; 906; 996; (1200)
c)	g-f-e-d-c-b-a-(g):	0; 204; 294; 498; 702; 792; 996; (1200)
d)	f-e-d-c-b-a-g-(f):	0; 90; 294; 498; 588; 792; 996; (1200)
e)	e-d-c-b-a-g-f-(e):	0; 204; 408; 498; 702; 906; 1110; (1200)
f)	d-c-b-a-g-f-e-(d):	0; 204; 294; 498; 702; 906; 996; (1200)
g)	c-b-a-g-f-e-d-(c):	0; 90; 294; 498; 702; 906; 996; (1200)

These figures are theoretically correct unless for some extraordinary reason Babylonian scholarship would have conceived scales with larger or shorter fifths and fourths. However,

one must remember that the construction of these scales are only the consequence of theoretical writing and do not constitute evidence for musicians having sung or tuned their instrument in this manner. Texts CBS 10996 and UET VII, 126 have shown that additionally to their positioning by means of numbers, intervals were also further qualified with specific terms. I contend that these would have indicated a manner of singing or playing instruments (mood) with variations on the original tonal quantification. For instance the interval *niš tuḫri* which would be c-b-a-g-f, tonally, might have been played 'moodally' or something like 'c, a slightly lower b, an A flat, normal g and f'. In a similar manner used today with *ajnas* in Maqam music, since *ajnas* (singular *jins*), are variations from a tonal basis, or what the Greeks call *genos,*'descendent, family' a term known to the Babylonians as *ginû* meaning 'descendent' and probably devanced by Sanskrit *jánas* meaning 'descent, birth'.

Quantification in UET VII, 126

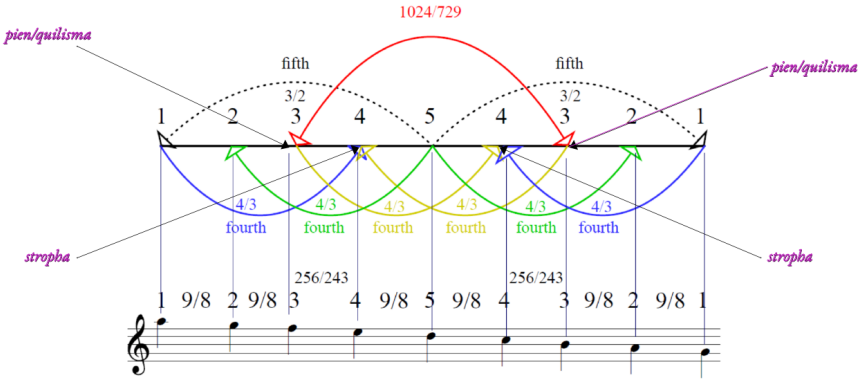


Figure 1. quantification from the indications in UET VII, 126

The illustration above indicates a construction predating the method in CBS 1766 where the alternation of fifths and fourths is undertaken on each of the fifths of the enneachord. It is only when the alternation crosses the boundary of the tonal centre that it generates semitones placed symmetrically between the third and the fourth strings of the front and between the third and the fourth strings of the back. The nature of the intervals in this construction are identical to the intervals in the first two examples, god numbers and CBS 1766 since 9:8 = 204 cents; 256:243 = 90; 9:8 + 9:8 = 408, a ditone which + 256:243 = 498, the fourth. The interval between strings 3 of the front and of the back are: (256:243 + 256:243 + 9:8 + 9:8) = (90 + 90 + +204 + 204) = 588, or the augmented fourth which is called *la zaku* in Akkadian, meaning 'not clear' or Procrustean interval, as known from text UET VII, 74 (pp. 41-62). The scale issuing from UET VII, 126 is either descending enneatonic scale of *pītum* a-g-f-e-d-c-b-a-g, or ascending enneatonic g-a-b-c-d-e-f-g-a with the following intervals:

Interval values	204	204	90	204	204	90	204	204
Descending scale	1404	1200	996	906	702	498	408	204
Ascending scale	204	408	498	702	906	996	1200	1404

Pitch quantification from the Nippur mathematical tables

The four cuneiform texts discussed here were originally published by Hilprecht in his twentieth volume of the *Babylonian Expedition of the University of Pennsylvania*, in 1906[5]. They were excavated from the temple library of Nippur and were part of some 7000 texts and fragments Hilprecht catalogued. They are dated about 2200 BC.

Hilprecht thought the texts were straightforward tables of multiplication and division. However, the purpose for these peculiar operations was not fully understood, mainly for the reason that in the early twentieth century, texts of theory such as UET VII 74; 126; CBS 1766 and CBS 10996, had not yet been satisfactorily interpreted. Although Hilprecht saw similarities with 'Plato's number' as laid out in Republic, Book VIII[6], He did not perceive that the lacunae of certain numbers, in addition to other mathematical purposes, could also have been the consequence of their relation to music theory.

Hilprecht noted that the four tablets shared three particular features:

1) When several multiplication tables are written together, the highest number begins the series. 2) The numbers multiplied are not consecutive, but are often separated from each other by comparatively large intervals. 3) Besides 3 and 5, no indivisible number or its multiple is multiplied. Note the absence of 7; 11; 13; 14; 17; 19; 21; 22; 23; 26; 28; 29; 31; 33; 34; 35; 37; 38; 39; 41; 42; 43; 44; 46; 47; 49; 51; 52; 53; 55; 56; 57; 58; 59; 61; 62; 63; 65; 66; 67; 68; 69; 70; 71; 73; 74; 75; 76; 77; 78 and 79.

Out of 81 numbers, 51 are omitted leaving, significantly, 30 numbers. The four fragmentary texts from which Hilprecht reconstructed one whole table, throw considerable light on the whole question of their possible musicological significance. The numbers in red are the quantification of the enneatonic scale with additional mood alternative pitches:

1	8.640.000 A-AN5	25	518.000	
2	6.480.000	27	480.000	
3	4.320.000	30	432.000	
4	3.240.000	32	405.000	
5	2.592.000	36	360.000	G
6	2.160.000	40	324.000	A
8	1.620.000	45	288.000	B
9	1.440.000	48	270.000	C
10	1.296.000	50	259.000	(C~#)
12	1.080.000	54	240.000	D
15	864.000	60	216.000	E
16	810.000	64	202.500	F
18	720.000	72	180.000	G
20	648.000	[80	162.000]	(A-21.5 cents)
24	540.000	[81	160.000]	A

They all have 12,960,000 (= 60^4 and 3600^2) as their dividend.

The Pythagorean right-angle triangle has sides which measure 3, 4 and 5. Therefore they have 3:4:5 as ratios between them. The ratio of 5:6 is made up from the doubling of side 3 in relation to the hypotenuse. Ratios of 1:2 and 2:3 arise from the halving of 4. Thus we have 1:2; 2:3; 3:4; 4:5 and 5:6. These ratios correspond to the first divisors in Hilprecht's reconstruction. However, the divisor '1' should relate to 12.960.000, and not to 8.640.000. Hilprecht was concerned by this discrepancy and wrote: 'I am unable to explain this strange phenomenon. Possibly we have to regard it as an abbreviated expression well understood by the Babylonians'. I do not see, either, any reason for this other than an irrational one, or, as Crickmore put it to me, in a recent communication: '...could line one, for example, be a concession to practical musicians, who are not generally noted for their mathematical expertise? Or, could it be a reminder for theoretical musicians that the whole of these tables can have an application in a musical context? Or is it simply the scribe's dedication of the table to Ea, the 'god' of music?' Indeed, if we read the sign as šuššu, = 60, Anu's number, referring to the musical string of 60 *ubanātu*, then 60 x 2/3 = 40 which is Ea's number.

The series which are relevant to musicology stand from 81 to 36.

81:80 = 21.51 cents = diatonic comma. It is also referred to as a Didymean comma because it is the amount by which Didymus corrected the Pythagorean major third (81:64, around 407.8 cents)[4] to a just major third (5:4, around 386.3 cents).

80:72 = 10:9	= 182.4 cents	= minor tone in just intonation.
72:64 = 9:8	= 203.91 cents	= major tone.
64:60 = 16:15	= 111.73 cents	= diatonic or just semitone.
60:54 = 10:9	= 182.4 cents	= minor tone in just intonation.
54:50 = 27:25	= 133.24 cents	= great limma.
50:48 = 25:24	= 70.66 cents	= small semitone.
48:45 = 16:15	= 111.73 cents	= diatonic or just semitone.
45:40 = 9:8	= 203.91 cents	= major tone.
40:36 = 10:9	= 182.4 cents	= minor tone in just intonation.

The particularity of these numbers is that they are regular. In music theory, they are pairs which differ by one. There are ten of them (x, x + 1) and each defines the superparticular ratio (x+1/x) for a musical interval. These are 2/1 (the octave), 3/2 (the perfect fifth), 4/3 (the perfect fourth), 5/4 (the just major third), 6/5 (the just minor third), 9/8 (the just major tone), 10/9 (the just minor tone), 16/15 (the just diatonic semitone), 25/24 (the just chromatic semitone), and 81/80 (the syntonic comma).

Conclusion

None of the music theory texts discovered so far have produced any tone numbers which do not agree with the Nippur Temple mathematical tables. Other columns where the numbers are in the form of n^2; n^3 and n^4 provide quantifications for more sophisticated intervals we find with Plato's 'two harmonies' which is precisely located in the n^3, in the range with Clio at 2,400; Euterpe at 2,700; Thaleia at 3,000; Melpomene at 3,200; Terpsichore at 3,600; Erato at 4,050; Polyhymnia at 4,320; Urania at 4,800 and Calliope at 5,400. In the 6th century AD, Boethius uses the same numbers, and so do later theoreticians such as Farabi, Avicenna, Safi ad-din, Salinas and many more.

Endnotes

[1] De la Fontaine, Jean, *Le laboureur et ses enfants*: Travaillez, prenez de la peine : C'est le fonds qui manque le moins. Un riche Laboureur, sentant sa mort prochaine, Fit venir ses enfants, leur parla sans témoins. Gardez-vous, leur dit-il, de vendre l'héritage Que nous ont laissé nos parents. Un trésor est caché dedans. Je ne sais pas l'endroit ; mais un peu de courage Vous le fera trouver, vous en viendrez à bout. Remuez votre champ dès qu'on aura fait l'Oût. Creusez, fouiller, bêchez ; **ne laissez nulle place Où la main ne passe et repasse.** Le père mort, les fils vous retournent le champ Deçà, delà, partout ; si bien qu'au bout de l'an Il en rapporta davantage. D'argent, point de caché. Mais le père fut sage De leur montrer avant sa mort Que le travail est un trésor.

[2] we use the term 'mood' instead of 'mode' for the reason that the latter has been significantly misused to the extent that there are a confusion of meaning to which it is attached. 'Mood' on the other hand has not yet been contaminated and although both terms have the same root, 'mood' better defines what I wish to convey.

[3] https://en.wikipedia.org/wiki/Sexagesimal

[4] Livingstone, Alasdair, *Mystical and mythological explanatory works of Assyrian and Babylonian scholars,* Clarendon Press, (Oxford, 1986), p.30; Reallexikon der Assyriologie, p. 499.

[5] Hilprecht, H.V., *The Babylonian Expedition of the University of Philadelphia* – Series A: Cuneiform Texts, (Hilprecht, ed.) Volume XX, Part I Published by the Department of Archaeology, University of Pennsylvania (1906).

[6] Adam, J., *The Republic of Plato*, Book VIII, appendices, pp. 264-318. (Cambridge, 1902)

H.6 = (RŠ13.30 + 15.49 + 17.387)

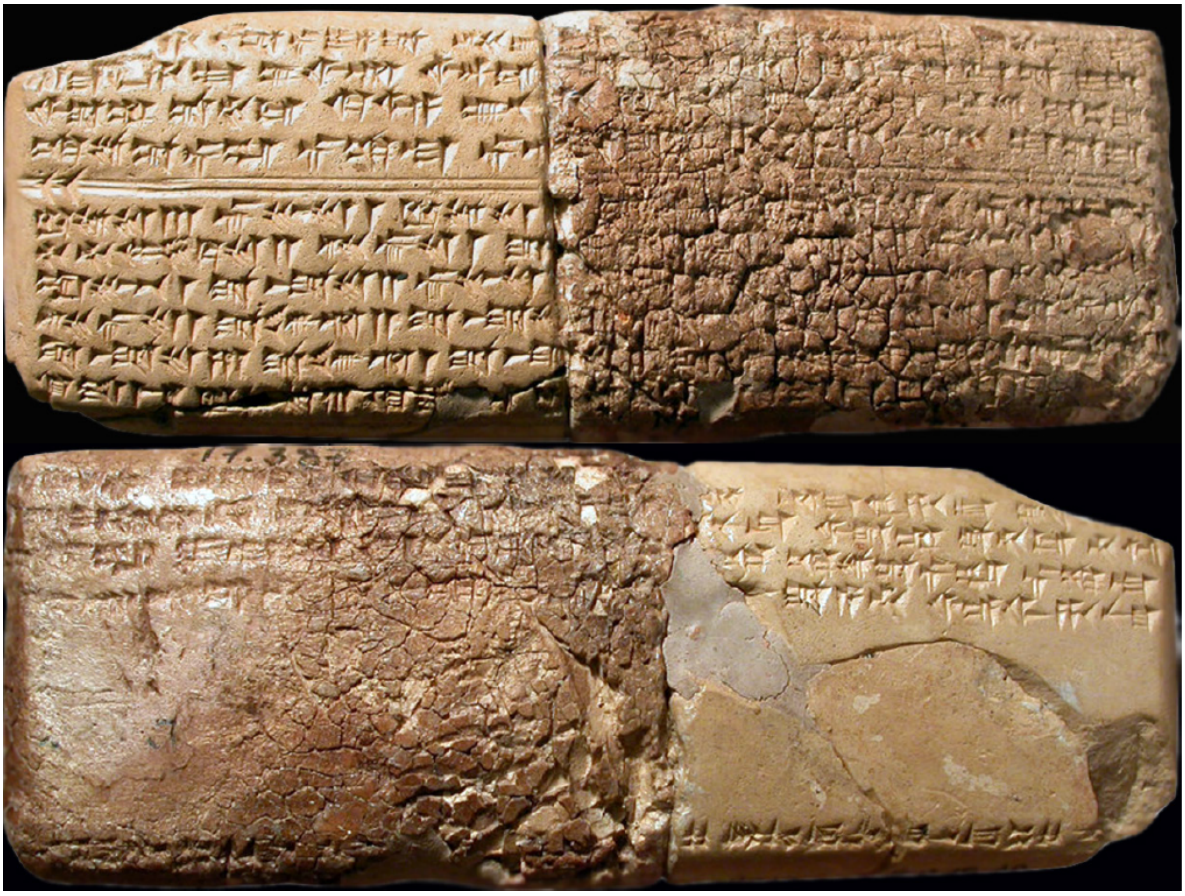


Figure 1. Tablet H.6 = (RŠ13.30 + 15.49 + 17.387), Obverse and Reverse. This tablet is hosted at the National Museum of Damascus.

Tablet H.6 is part of a collection of about twenty-nine fragmentary cuneiform clay tablets unearthed during the pre and post war Missions at Ras Shamra, Syria, conducted by the French scholar Claude Schaeffer. The tablets are written in Hurrian, an agglutinative language, with Babylonian signs. The scribes who wrote them were Babylonians as their names and usage of Hurrianised Babylonian suggests. The tablets would all have had the same rectangular shape. The writing is parallel to the longest side and is divided in three parts. The first varies with each tablet, but generally the text continues onto the obverse. The text usually consists of one paragraph which ends with a double line on which sits a double winkelhaken[1], at the beginning and at the end, on the obverse.

The second part spreads below the double line, with Hurrianised Babylonian musical terms which are followed, in most cases, by a number. Terms sometimes have pre or post-positioned adjectives. The first part gives the lyrics, the second music and rhythm. The third part is the colophon written at the bottom edge of the tablet. Typically, its says that it

is ' . . . a song in the scale of 'x', followed by an adjective and deities to whom the song is dedicated. Follows the name of a scribe. Two of them are mentioned in the texts. There is a certain *Ammurabi*, another, *Ipšali*, and four Hurrian composers: *Tapšiḫun*, *Puḫiyanna*, *Urḫiya* and *Ammiya*. This is to our knowledge the first instance when composers are named, in world music history. Regrettably, H.6 is the only tablet which came reasonably intact to us, reconstructed from three fragments: (RŠ13.30 + 15.49 + 17.387).

The colophon of tablet H.6 is unequivocal: It reads:[*an-nu*]-*ú za-am-ma-rum ša ni-id-kib-li za-l*[*u*]-*z*[*i ša* **DINGIR.MEŠ TA** ^{m}*Urḫiya*] *šu ammu-ra-bi*, which translates as: 'This is a song in the scale of *nidqibli* a *zaluzi* for the gods, written by *Urḫiya* and composed by *Ammurabi*'. It is a song, unequivocally. There are no indications of any instrumental accompaniment. Furthermore, an instrumental accompaniment to this song/prayer, as far as we understand it, would be incongruous with the private nature of this young woman's prayer asking goddess Nikkal to make her fertile.

We shall only discuss music notation. Our knowledge of Hurrian is still limited and therefore the vocalisation of the language remains uncertain, especially that it is written with Babylonian signs not ideally suited and therefore cannot provide with meaningful metric values.

The colophon says that the song is in the pitch set of *nid kibli*. The nature of this scale has been elucidated from three texts: CBS 10996, UET VII, 126, and UET VII, 74, already discussed. *Ni-id-kib-li* (Hurrian), *nīd qablim* (Babylonian) is an enneatonic descending scale: e-d-c-b-a-g-f-e-d. The values for melodic melodic thirds and fifths are known from the transposition of the string numbers to the enneatonic scale of *nīd qablim*. This is a straight forward operation.

The music part of the tablet is composed of the names of melodic thirds and fifths and of numbers following each of them:

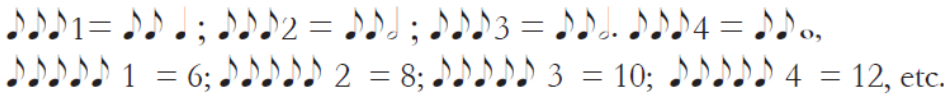
Line 5. [*qablite* 3] [*irbute* 1] [*qablite* 3] [*šaḫri* 1] [*titimišarte* 10] *uštamari*.....?
Line 6. [*titimišarte* 2] [*zirte* 1] [*šaḫri* 2] [*šaššate* 2] [*irbute* 3] [*šaššate* 2]
Line 7. [*umbube* 1] [*šaššate* 2] [*irbute* 2] [*nadqabli* 1] [*titur qablite* 1] [*titimišarte* 2]
Line 8. [*zirte* 1] [*šaḫri* 2] [*šaššate* 4] [*irbute* 1] [*nadqabli* 1] [*šaḫri* 2]
Line 9. [šaššate 2] [*šaḫri* 1] [*šaššate* 2] [*šaḫri* 1] [*šaššate* 2] [*irbute* 4]
Line 10. [*kitme* 2] [*qablite* 3] [*kitme* 1] [*qablite* 2] [*kitme* 1] [*qablite* 3]

Some numeric values could not be clearly read because of the damage to the tablet.

The melodic value for the melodic triads and pentads in H.6 is: *umbube* = c-b-a-g-f; *nadqabli* = b-a-g-f-e; *qablite* = a-g-f-e-d; *kitme* = g-f-e-d-c; *titur qablite* = b-c-d; *titimisarte* = a-b-c; *zirte* = g-a-b; *šaḫri* = f-g-a; *šaššate* = e-f-g; *irbute* = d-e-f.

With regard metrics, each melodic fifth has five time units and each melodic third has three. Remains to determine the length value of the numbers which follow. We take it that Hurrian composers would not have devised some obscure and complex method with

which to express rhythm, after all, music indications are there to enlighten and not to obscure. We also assume, in the present interpretation, that the length of time units were the same for fifths and for thirds. Our contention is that the last member of an interval was prolonged by a quantity defined by the number which follows. The only reasonable quantity would be:



When this method is applied to the intervals, and taking in consideration the damage of the tablet, lines 6 to 9 would have 36 beats each. Lines 6 and 10 would vary, as line 6 is introductory and line 10 jumps into line 6 as a catchline for the repeat indicated both by the double winkelhaken and the lyrics. This regularity in the metrics of the piece further proves that the thirds and fifths were melodic and not harmonic.

Line 5. [*qablite* 3] = 10 [*irbute* 1] = 4 [*qablite* 3] = 10 [*šaḫri* 1] = 4 [*titimišarte* 10] = 22 + [*uštamari*..... ? = 50+
Line 6. [*titimišarte* 2] = 6 [*zirte* 1] 4 [*šaḫri* 2] = 6 [*šaššate* 2] = 6 [*irbute* 3] = 8 [*šaššate* 2] = 6 = 36
Line 7. [*umbube* 1] = 6 [*šaššate* 2] = 6 [*irbute* 2] = 6 [*nadqabli* 1] = 6 [*titur qablite* 1] = 4 [*titimišarte* 2] = 6 = 34?
Line 8. [*zirte* 1] = 4 [*šaḫri* 2] = 6 [*šaššate* 4] = 10 [*irbute* 1] = 4 [*nadqabli* 1] = 6 [*šaḫri* 2] = 6 = 36
Line 9. [*šaššate* 2] = 6 [*šaḫri* 1] = 4 [*šaššate* 2] = 6 [*šaḫri* 1] = 4 [*šaššate* 2] = 6 [*irbute* 4] = 10 = 36
Line 10. [*kitme* 2] = 8 [*qablite* 3] = 10 [*kitme* 1] = 6 [*qablite* 2] = 8 [*kitme* 1] = 6 [*qablite* 3] = 10 = 48?

Note that Line 5 could equal 72 on account of the unknown *uštamari* value; Line 7 could have misread a value and be 36; Line 10 could be 36 since the last interval [*qablite* 3] = 10 is a catchline for line 5.

In the Spring of 2011, in Damascus, at the Dar al-Assad Opera House, I presented my version of H.6 with some emotion, as the original tablet was resting only a few hundred metres away. I was quite anxious about reactions from maqam masters present. Some started to hum as if they had known the music from some distant memory, firmly anchored in their unconscious. Later, we engaged in enthusiastic discussions and the terms *bayati*, *hijazi* and others recurred. These musicians gave mood to this otherwise tonal melody.

Then, it became obvious that Babylonian music theory, Hurrian songs and the Oriental Maqam shared the same origins.

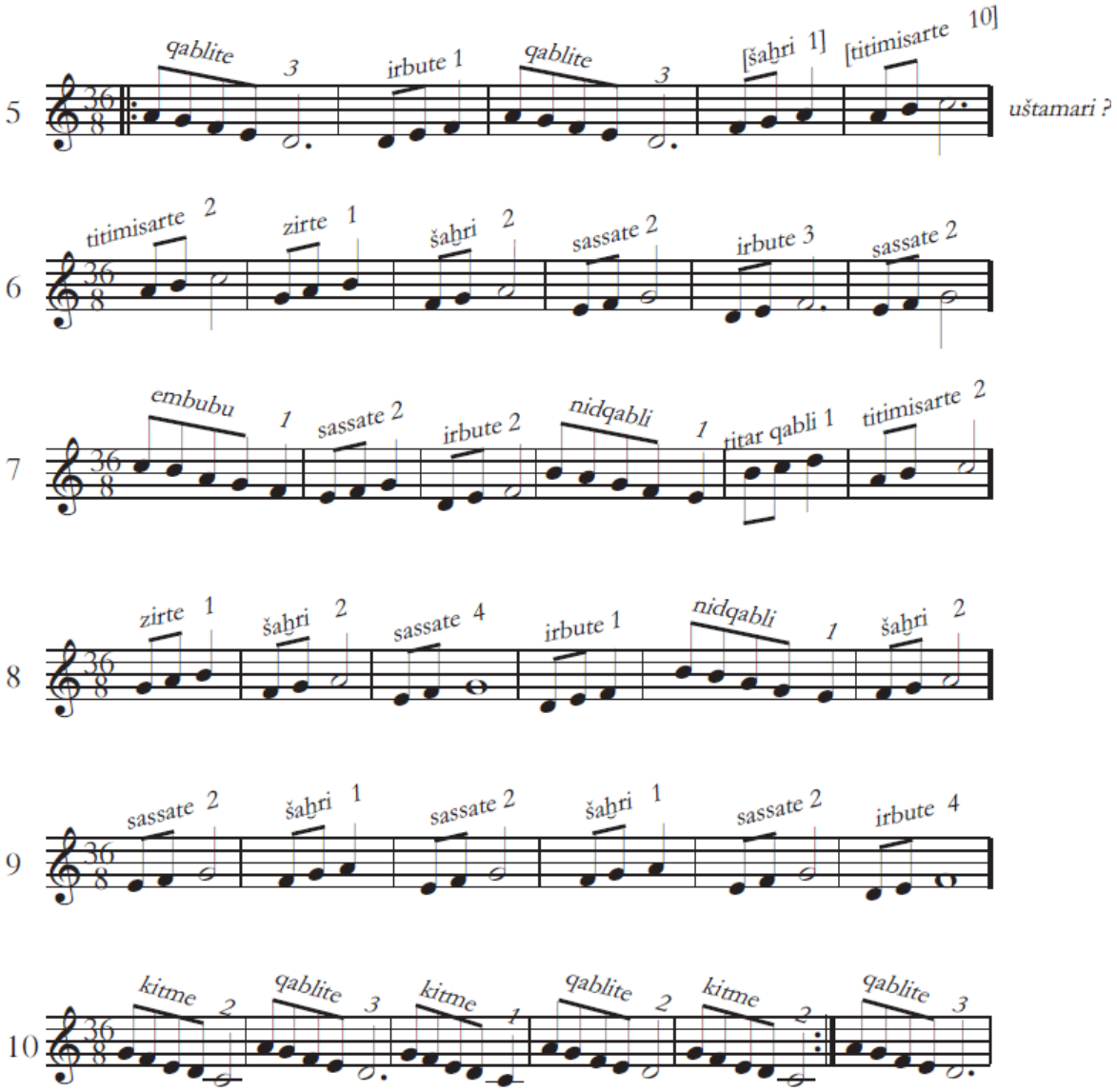


Figure 27. The author's tonal interpretation of H6.

Endnotes

[1] The Winkelhaken, from the German ‘angular hook’, also simply called a hook, is one of five basic wedge elements appearing in the composition of signs in Akkadian cuneiform. It was realised by pressing the point of the stylus into the clay.